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December 15, 1925
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Journal of Electricity

Devoted to the Economic Production and Commercial Application of Electricity
IN THE ELEVEN WESTERN STATES

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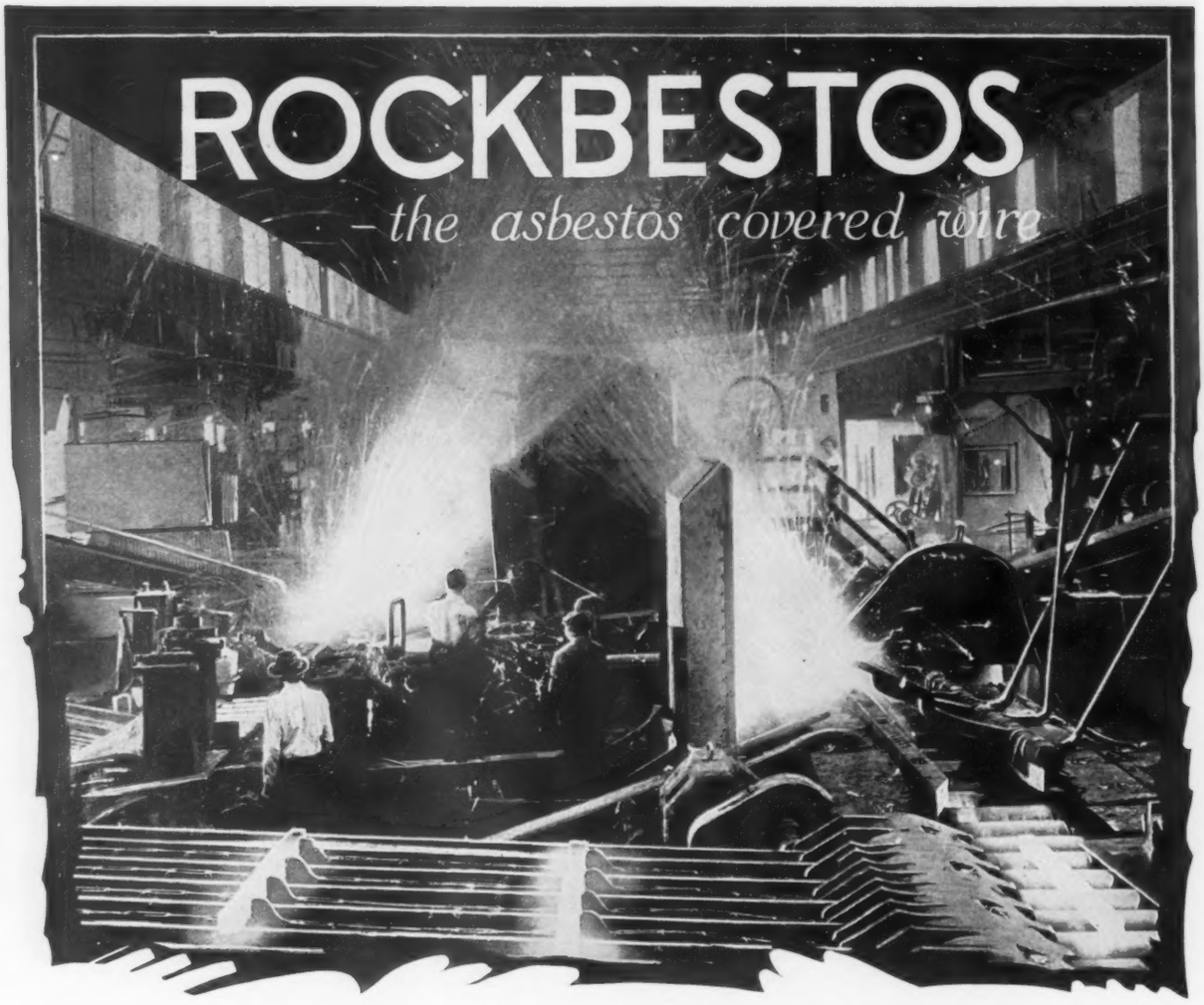

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THERE is a safety zone in industrial selling beyond which a manufacturer cannot go without suffering losses. This border between profitable and unprofitable selling can be set down by any manufacturer whose products are used in industry if he will apply to his particular selling job the McGraw-Hill Four Principles of Industrial Marketing. These principles, as laid down in the seventh of a series of national newspaper advertisements, a copy of which appears on pages 42 and 43 of this issue, are:

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EDITORIAL

The Customer-Owner and the Holding Company

IN the scant eight years since the inception of the customer-ownership idea the industry has come to look upon this movement as a panacea for almost all real or imaginary disruptions in the public relations system. This attitude is thoroughly justifiable, for theoretically and practically a satisfied group of customers owning securities in the utility which furnishes them an essential service is a distinct asset. Moreover, the value of this asset increases in direct proportion as these customer-owners are made to feel that they are partners in the business and as such are entitled to the rights of partnership in more than the mere sense of receiving quarterly dividend checks.

With a utility locally owned and locally managed in the fullest sense of the word such a situation undoubtedly holds. Under such circumstances a customer-owner enjoys a feeling of pride in his utility that will manifest itself in an immediate rise to the defense of the company should its position become jeopardized through an attack by politicians or others unfriendly to its interests.

But what happens to this feeling of pride and partnership when a local utility is absorbed by a holding company whose headquarters are thousands of miles removed, as in the case of the holding companies which recently have taken over some of the Pacific Coast utilities? As one utility executive recently put it, is not the customer-owner likely to feel his partnership was rather a hollow affair in the first place, that as a partner he was neither consulted nor considered? Add to this his suspicion when through the financial pages of the press he sees the fluctuations of the common stock—would he not be justified in thinking that he has been treated unfairly?

In the case of those utilities which have been taken over by holding companies, it would seem that the problem which they now face is one of reselling the customer-owner. He must be made to feel that the affiliation of his company with a national organization has strengthened its position; that this affiliation in no sense has altered his position as partner in the business. This can be done by taking the customer-owner into confidence even more fully than has been the practice in the past. It would be a comparatively simple matter to address a letter to him directing attention to the improvements which the utility is making. The employee who sold him his securities in the first place could call on him every so often, pointing out additions the company is making in his neighborhood and asking him if he has any suggestions regarding service or management which his position as a partner entitles him to convey to those who are running the business for him. Even the telephone could be used under the circumstances to give him assurance that his opinions are both desired and valued.

Nor is this a problem of the utilities mentioned alone. All companies which have adopted the customer-ownership idea could well afford to devote some thought and attention to keeping the customer-owner sold.

The Ontario Bubble Bursts Once Again

"THE Ontario Hydro-Electric system is customarily represented as an experiment in 'public ownership'. It is really an attempt on the part of a small number of politicians to establish an industrial monopoly and to manage this monopoly in such a way as to keep themselves in power. In order to effect this object they have violated constitutional law and practice; they have assumed absolute authority; they have closed the courts of justice against proceedings adverse to themselves, and they have encroached upon the liberties of the people." Rather a strong indictment of a project with which politicians have cajoled and beguiled the American voter for lo, these many years. But an indictment nevertheless because it comes from the pen of the late James Mavor, emeritus professor of political economy in the University of Toronto.

For those of our readers who feel that Professor Mavor may not have made his case against the Hydro-Electric Commission sufficiently strong, we will quote one more passage from his new book, "Niagara in Politics," and refer them to the review of this work on another page of this issue;

"They (the Hydro Commission) have saddled the Province with an enormous debt on account of a group of enterprises, the returns from which must be, in the nature of the case, of a fluctuating and speculative character. They have embarked upon a series of complicated industries for the management of which they have exhibited no aptitude and for which they have had none of the necessary training and experience. They have . . . .voted themselves large salaries for their incompetent labors. They have in many cases broken promises solemnly made. Instead of reducing the cost of power, there are signs that they must ere long increase that cost to the consumers. The temporarily low rates cannot be maintained or the enterprise must become insolvent. The eventual economic loss may be very considerable; but the political injury which they have already inflicted upon the public life of the

Province is the most important fact adverse to their credit and to the credit of the people and the press who have placed their necks blindly under the yokes of the politicians."

Undoubtedly Professor Mavor's book will arouse a greater storm of invective and criticism from the politicians and their friendly press than the well known Murray and Flood report of 1922 or the more recent Wyer report on the affairs of the Commission. There are many reasons why such criticisms and any amount of rebuttal which the Commission might offer will fall short of its mark. In the first place Professor Mavor makes few, if any, statements regarding the Commission which are not substantiated by either the recorded word of government officials or by written reports and official documents. Secondly, his earlier work, "An Economic History of Russia," established him as an international authority on political economy. Lastly, he has resided for years in Toronto, the chief city of Ontario, where he has had an opportunity of observing closely the creation and the growth of the Hydro-Electric Commission and of studying its effect upon both the people and the government.

Because the alleged success of the Ontario project has been one of the chief weapons of the political proponents of state and municipal ownership in the Pacific Coast states, "Niagara in Politics" will be welcomed by the electric light and power industry as well as by students of political economy. We recommend it not only to both of these classes but also urge a conscientious study of its pages by those newspaper editors whose columns would lead the public to believe that by following in the footsteps of Ontario California, Oregon and Washington will find a political millenium.

A Discussion —and a Debate

NOT since the National Electric Light Association convention has there been a meeting in the West of more significance to the electrical industry here than that held in Seattle recently by the Western Division of the Chamber of Commerce of the United States. We refer to the session devoted to the hydroelectric power situation in the West reported elsewhere in this issue. The foregoing statement is made advisedly in view of the fact that a group of bankers, business men, newspaper editors and Chamber of Commerce officials heard a remarkable presentation of the development of the industry under private ownership coupled with a debate on the subject in which there was no mincing of words and spades were called spades.

A moving picture, in the production of which eminent engineers on the Coast had collaborated using the latest art in motion picture production, portrayed the development of the industry in the past forty-five years in a manner described by spectators as the most forceful graphic presentation of this industrial phenomenon yet produced. Supplementing and enlarging on the picture, the story of private enterprise was told by R. H. Ballard, vice-president, Southern California Edison Company and O. B. Coldwell, vice-president, Portland Electric Power Company, representing their respective districts, while the development under municipal operation was ably presented by J. D. Ross, superintendent, Seattle municipal power system, and Ralph Criswell, Los Angeles city councilman. Sandwiched between the last two was Norwood Brockett, director of public relations, Puget Sound Power & Light Company, whose telling arguments against municipal ownership were delivered with his characteristic "punch" in certain and specific language.

With this array of talented speakers placed opposite one another on the program, it may be imagined that the meeting took on some of the aspects of a good boxing card, in which the contestants stood off and hammered each other instead of rushing into clinches. No referee rendered a decision and the audience was generous with its applause for all contestants, but if we are any judge of reactions, private enterprise had the edge.

Broadening Our Scope of Service to the Industry

ON another page of this issue is announced the consummation of an arrangement between the Journal of Electricity and the Northwest Electric Light and Power Association identical with that now existing between the Journal and the Pacific Coast Electrical Association. The Journal of course is gratified at the action taken in the Northwest, partly because it would seem that our judgment in placing a representative in that territory, the more intensively to cultivate it editorially, has been vindicated. But more particularly we are gratified at the opportunity presented to broaden our scope of usefulness.

We long have realized the importance of that great section of the West and recognized the value to the industry of the work done by its association. Now that that association sees fit to utilize our services more fully we may feel that we are assisting in its work, and our part in furthering the interests of the electrical industry becomes the more important. Thus acknowledging the added responsibilities entailed, we pledge ourselves to discharge them diligently.

Why Not First Aid?

WE read in a recent issue of a Sacramento Valley paper that a young man who was operating a ditch-digging machine met his death when the boom of the machine came in contact with a high-tension line. The fact of itself unfortunately is not uncommon. That which arouses special comment is the statement of the press that medical aid was summoned but that the victim died in the meantime. This points directly and unequivocally to the fact that if any one of the construction crew had been familiar with the Schaefer method of resuscitation the young man probably would have recovered.

Much credit is due to those far-seeing persons in the industry who are spreading this gospel even in the face of shortsighted opposition. It is to be

hoped that a knowledge of this important first-aid measure soon will find its way not only to all corners of the electrical industry but through it to other fields.

Ice Men Will Not Be Left in the Cold

THAT the ice manufacturers of the United States estimate their losses, due to household electrical refrigerators, to be about $10,000,000 for the year, as a report made at the recent convention of the National Association of Ice Industries at Los Angeles shows, is a matter worthy of considerable attention both from the standpoint of the ice manufacturer and that of the electrical industry. To the ice men the question is one of grave concern. To the electrical industry it is an indication of the trend toward electrical household refrigeration which is just beginning to become notable. To the former it presents a menace to their business, and to the latter an opportunity undreamed of a few years ago.

The problem has its delicate angles. It has not been long since the ice manufacturers recognized that electricity was the ideal motive power for the operation of their plants. And now the new friend, as it were, appears to turn upon them. Yet it is impossible to turn back now, even if it were desirable. Domestic refrigeration has come to stay, there is no longer any doubt of that. It offers to the housewife too many advantages over the old methods of refrigeration not to supplant ice for a clean, quiet, efficient and constant electric servant.

Be it said to their credit, the ice manufacturers through their committees seem to favor a commonsense and constructive attitude in the matter. Their committee, in its report at the Los Angeles convention, as well as in the discussion following the reading of that report, favored a policy of non-antagonism, and one rather of co-operation with the electrical industry in the extension of the use of any and all kinds of refrigeration in the home.

That many ice manufacturers indicate a desire and indeed are planning a genuine effort in the selling of electrical household refrigeration machines is a commendable tendency. It would be useless, although perhaps natural enough, to attempt to discredit their electrical competitors. Such a policy would reflect badly upon their own business and hurt refrigeration in general.

But the idea of going into the merchandising field themselves to place electric refrigerators in the home where they find a desire for such places them in a most creditable light, both from a position of public relations and in relation to the electrical industry as well.

And although in a naturally favored position in respect to future refrigeration development, it behooves the electrical industry to show itself fair and gracious. For although favored of fortune in this instance, the good will and good opinion of the ice industry are worth more to the electrical industry than any temporary commercial advantage it may happen to enjoy by reason of public preference. As builders of community development, it is to the interest of the utility companies to protect and foster the interests of all members of their communities, and the ice manufacturers as such demand the utmost consideration in a situation which threatens their welfare. Co-operation between ice manufacturer and electrical industry can bring about a mutual development which eventually will be to the best interests of each community.

New Inspectors' Association Merits Support

A NEW association being formed in the Northwest is worthy of the support of the electrical industry. We refer to the Northwest Association of Electrical Inspectors to appear on the scene in January when the first meeting will be held in Portland, as disclosed in a news item in this issue. It is understood that the efforts of the organizers, F. D. Weber, of the Oregon Insurance Rating Bureau, Portland, and H. A. Patton, of a similar bureau in Seattle, are meeting with some success, and that the infant organization will start life with a robust body and healthy mind, and this is all we could wish for any new-born babe.

Regulation and inspection of electrical installations have long been with us and are here to stay. For the most part, wiring codes and insurance requirements have been welcomed by the industry and have done much not only toward the reduction of fire and personal hazard, but also for the general good through standardization of equipment and practices and through education of the contractor and public. As an example of this we would cite the city of Portland, whose code is recognized as being among the best municipal codes in the country, and among those adequately administered. Year after year has witnessed improvement in the standards of wiring and increase in the use of electrical energy in that city, in spite of the fact that neither electric club nor contractors' association has ever been long-lived there. After giving due credit for this improvement to the educational work done among the contractors and public by the power companies, it will be admitted that the code and its administration likewise have been a large contributing influence.

If results in Portland have been reasonably satisfactory in this respect without formal organization to foster the movement, it is because Portland is among the few proverbial exceptions. Generally speaking, such improvements are more or less directly proportionate to the organized co-operative effort exerted in their behalf, and it is quite possible that even in Portland the industry might expect to benefit from an organization of electrical inspectors that will draw to it other elements of the industry interested in the inspectors' problems. Certainly there is room for improvement everywhere, and because the Northwest is not over-organized with clubs, leagues and associations, it would seem that this new organization should find a definite place in the scheme of things there. We wish it success.

OUTSTANDING among the power developments of the past year is the Baker River project of the Puget Sound Power & Light Company. This view, looking upstream, shows the power house at the left and the operators' cottages at the right. Above the cottages may be seen some of the camp buildings and above the power house is the concrete mixing plant.

The Baker River Development

A Discussion of the Hydraulic Features

By William D. Shannon

General Superintendent, Division of Construction and Engineering, Stone & Webster, Inc., Seattle

UNIQUE among power developments of the Pacific Coast is the Baker River project of the Puget Sound Power & Light Company. Geological and other natural features made the site almost ideal. A narrow rock-walled gorge for the dam site, a bed of gravel at the lower end of the reservoir site, a short tunnel and this through tight rock, a cement mill within a mile of the project, and the presence on the property of concrete warehouses of an abandoned mill are some of the unusual features.

BAKER River is one of the most important branches of the Skagit River system, all of which is situated in the northern part of the state of Washington and in southern British Columbia. This river has a drainage area of 270 sq. mi., of which approximately one-eighth is above El. 5,000, U.S.G.S. datum. It rises on the southern slope of a spur of the Cascade Mountains between Mt. Baker and Mt. Shuksan. The former is an extinct volcano rising to a height of 10,750 ft. and the latter rises to a height of 9,038 ft. Both are covered with perpetual snow and have numerous glaciers which aid in storing the precipitation during the winter months. Mt. Baker, the higher of the two, has more extensive snow and ice fields, but both contribute greatly to the summer run-off of the Baker River watershed. Very little snow falls on the lower reaches of the river, but in the sheltered portions of the river basin snow is found throughout the winter months down to an elevation of 500 ft. above sea level. Snow occasionally falls over the entire basin, though snow falling below El. 500 as a rule does not stay on the ground any great length of time.

Only some 20 miles in length and an average of one-half mile in width, the valley of the river is flanked by high mountain ranges on both its east and west sides. At the upper end of the valley the terrain rises rapidly to the summits of the surrounding mountains. This whole country is distinctly mountainous and abounds in water courses which have their origin either in springs or in the melting snow and ice. The lower portions of the watershed are covered with huge gravel and clay deposits and the upper reaches are largely of volcanic origin, there being a large number of lava flows showing above the strata of limestone and other native rock.

Eroding its channel all the way from the summit of the mountain range to the river's confluence with the Skagit, the Baker River, in a number of places along its length, has cut deep gorges through the various strata of solid rock. In one of these narrow canyons is located on the Baker River development.

Rainfall on the Baker River watershed is typical of a number of areas in the Puget Sound Basin. On the lower reaches of the river the precipitation is very largely in the form of rain while on the upper reaches of the basin it is almost entirely snow during the winter period. Precipitation in the upper portion of the watershed is probably as high as 200 in. a year, though no actual data other than the river flow are available. Table No. 1 shows the precipitation for the month of February, 1925, which is typical of the winter season in the lower reaches of the river. During this same month it is probable that the precipitation in the upper basin was very much greater than this.

Table No. 1

Typical Precipitation and Average Temperature at Site of Baker River Development, February, 1925.

Date	Precip.	Temp.	Date	Precip.	Temp.
Feb. 1	1.09	41	Feb. 16	.....	41
Feb. 2	.68	42	Feb. 17	.....	43
Feb. 3	.89	43	Feb. 18	.....	43
Feb. 4	.87	37	Feb. 19	.11	40
Feb. 5	.44	40	Feb. 20	.56	40
Feb. 6	.30	38	Feb. 21	.50	42
Feb. 7	.40	42	Feb. 22	.70	42
Feb. 8	.87	38	Feb. 23	.43	42
Feb. 9	.06	39	Feb. 24	.28	42
Feb. 10	.08	38	Feb. 25	.74	40
Feb. 11	.....	37	Feb. 26	.85	41
Feb. 12	.....	45	Feb. 27	.12	40
Feb. 13	.....	45	Feb. 28	.....	40
Feb. 14	.02	43			
Feb. 15	.....	40	Total	9.99 in.	

Average .357 in. per day.

Table No. 1 also shows typical daily winter temperatures at the site of the Baker River power plant during the month of February, 1925. During that month there was practically no freezing weather and very little frost to contend with at that point. There may be an occasional week during the winter months when the temperature gets below the freezing point, but such is the exception rather than the rule. On the upper reaches of the river, however, the weather gets extremely cold and this fact tends to hold back the snow and ice during the winter months.

Table No. 2 shows the temperature during the month of June, 1925, and is typical of the summer

months in the region of the plant. It is during the months of July and August that the melting snow and ice augment the normal river supply which otherwise by that time would have been decreased greatly owing to the decreased rainfall.

Table No. 2

Mean Temperatures at Baker River, June, 1925.

Date	Temp.	Date	Temp.
June 1	55	June 16	64
June 2	55	June 17	60
June 3	51	June 18	59
June 4	51	June 19	51
June 5	56	June 20	65
June 6	59	June 21	66
June 7	58	June 22	64
June 8	61	June 23	59
June 9	57	June 24	64
June 10	60	June 25	72
June 11	54	June 26	80
June 12	60	June 27	67
June 13	53	June 28	60
June 14	54	June 29	58
June 15	62	June 30	60

Run-off

Owing to the rocky character of the Baker River watershed the run-off is proportionately high compared to the rainfall. The average run-off for the upper portion of the watershed between 1911 and 1924 was 11.15 sec.ft. per sq. mi. At times of heavy rainfall there often occurs a warm southeastern wind, known locally as a Chinook, which melts the new fallen snow on the mountains. This, together with the heavy rainfall on the lower reaches, tends to bring a heavy run-off on the river and floods result. At such times the stream flow at the power site is as high as 27,000 sec.ft., this figure being estimated for Dec. 29, 1917. Flood conditions sometimes last for three or four days. During some winters there may be as many as two or three of these floods, but as a rule there is not more than one such condition during any one season. However, there may be some minor floods due to heavy precipitation alone.

Table No. 3

Stream Flow at Site of Baker River Development, July, 1922.

Date	Stream Flow	Date	Stream Flow
July 1	3,590 sec.ft.	July 16	2,075 sec.ft.
July 2	4,020 "	July 17	2,295 "
July 3	4,670 "	July 18	2,400 "
July 4	4,670 "	July 19	2,395 "
July 5	4,140 "	July 20	2,070 "
July 6	3,870 "	July 21	1,860 "
July 7	3,420 "	July 22	1,670 "
July 8	2,900 "	July 23	1,540 "
July 9	2,580 "	July 24	1,620 "
July 10	2,400 "	July 25	1,675 "
July 11	2,400 "	July 26	1,675 "
July 12	2,460 "	July 27	1,720 "
July 13	2,700 "	July 28	1,810 "
July 14	2,480 "	July 29	1,860 "
July 15	2,240 "	July 30	1,915 "
		July 31	1,915 "

Note.—Watershed area = 270 sq. mi.

Table No. 4

Stream Flow at Site of Baker River Development, January, 1918.

Date	Stream Flow	Date	Stream Flow
Jan. 1	20,200 sec.ft.	Jan. 16	1,950 sec.ft.
Jan. 2	15,200 "	Jan. 17	3,980 "
Jan. 3	12,200 "	Jan. 18	7,960 "
Jan. 4	13,100 "	Jan. 19	6,600 "
Jan. 5	13,500 "	Jan. 20	3,820 "
Jan. 6	9,050 "	Jan. 21	2,510 "
Jan. 7	9,240 "	Jan. 22	2,330 "
Jan. 8	7,300 "	Jan. 23	2,240 "
Jan. 9	4,160 "	Jan. 24	1,950 "
Jan. 10	2,860 "	Jan. 25	2,060 "
Jan. 11	2,390 "	Jan. 26	1,950 "
Jan. 12	2,590 "	Jan. 27	1,850 "
Jan. 13	2,210 "	Jan. 28	1,700 "
Jan. 14	2,105 "	Jan. 29	1,660 "
Jan. 15	2,000 "	Jan. 30	1,615 "
		Jan. 31	1,560 "

Note.—Watershed area = 270 sq. mi.

In the summer months of July and August the river is fed entirely by springs and the melting snows and may drop to 1,200 sec.ft. Table No. 3 gives the stream flow of Baker River at the powerhouse site during a typical summer month. Table No. 4 shows the same during a typical winter month. If the fall rains are late for any reason an occasional dry spell may bring the river down to as low as 700 sec.ft. As a rule this low-water period lasts but a short time and occurs only infrequently. One extraordinary low-water period brought the river down to 220 sec.ft., yet notwithstanding this the yearly mean run-off was up to normal. Table No. 5 gives the annual flow of Baker River at a point eight miles above the power site and also gives the maximum and minimum stream flow for all years from 1911 to 1924.

Table No. 5

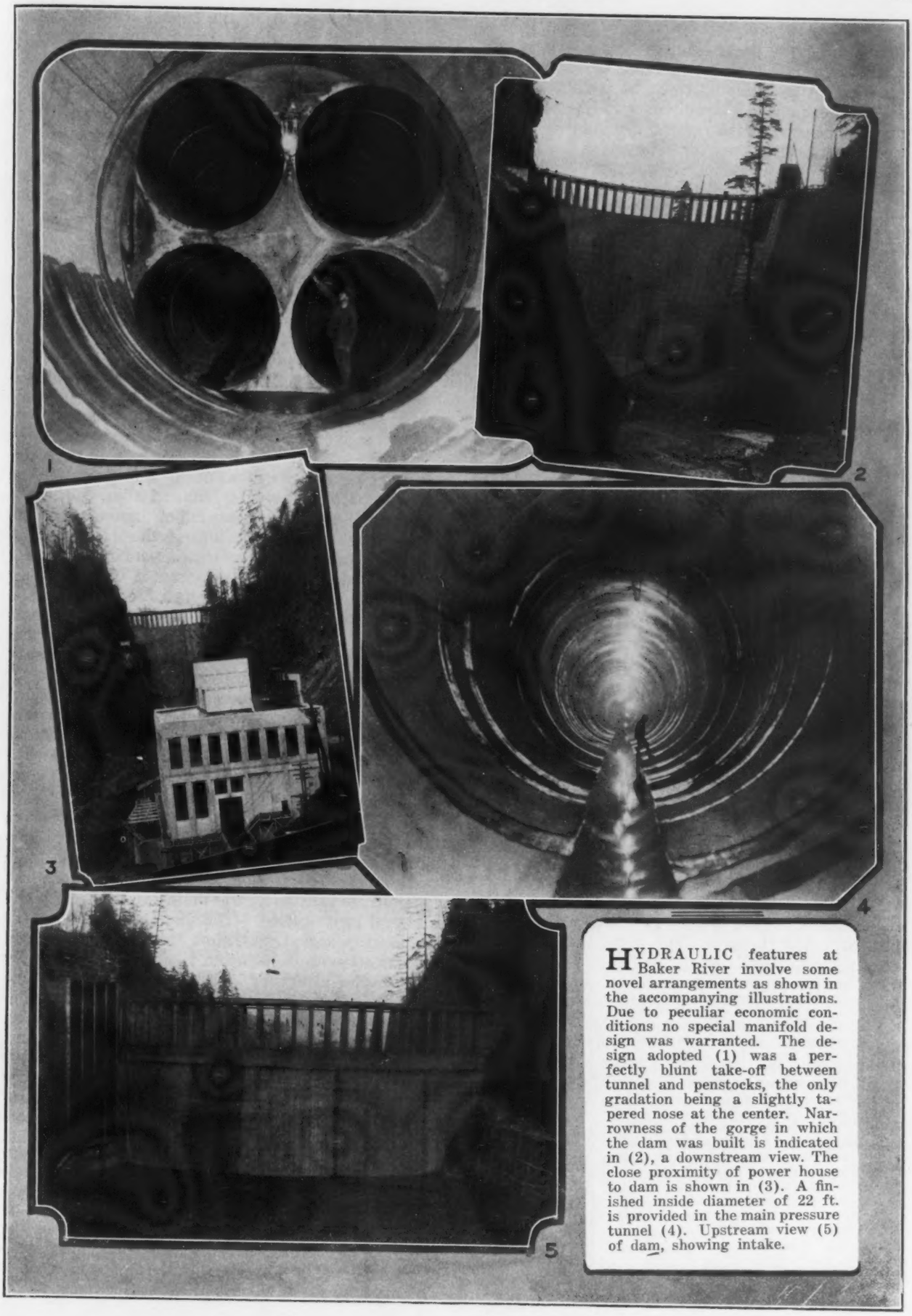
Flow of Baker River at Anderson Creek Station. Area of Watershed = 184 sq. mi.

Year	Stream Flow in Sec.ft. Maximum	Minimum	Mean	Mean Run-off per Sq. Mi. in Sec.ft.	Total Annual Run-off in In.	Total Annual Run-off Acre-ft.
1911	.....	410	2,250	12.2	166.39	1,630,000
1912	6,280	524	1,940	10.5	143.28	1,410,000
1913	7,750	457	2,200	12.0	162.22	1,590,000
1914	22,700	431	1,970	10.7	145.77	1,430,000
1915	17,200	554	1,660	9.0	122.07	1,200,000
1916	12,600	525	2,190	11.9	161.69	1,590,000
1917	7,600	508	1,910	10.4	141.36	1,390,000
1918	27,400	505	2,600	14.1	191.74	1,880,000
1919	14,800	591	1,980	10.8	146.24	1,440,000
1920	16,000	220	2,000	10.9	147.58	1,450,000
1921	17,800	660	2,350	12.8	173.40	1,700,000
1922	19,600	398	2,030	11.0	149.84	1,470,000
1923	9,510	.....	1,790	9.7	132.19	1,300,000
1924	16,700	460	1,830	9.9	134.98	1,330,000
	14 Year Average			11.15		

Storage

The area of the water surface of the reservoir when filled to El. 405 will be 1,805 acres. The maximum depth of the reservoir is at the dam and is 200 ft. It is planned to operate the reservoir with the surface of the water in the range between 360 and 405, giving a maximum draw-down of 45 ft. and a useful storage of 70,000 acre-ft. above El. 360. From October through the end of July it will be rare indeed that water will not be going over the spillway of the dam. Occasionally there may be a period in midwinter when a spell of cold weather may hold back the stream so that it might drop to 1,500 or 2,000 sec.-ft. At rare intervals it has been known to drop for a few days to 600 sec.ft. As a rule, however, such periods last but a short time, and any intermittent floods will keep the reservoir more than full except under the special conditions noted. The months of August and September, therefore, will require water to be taken from storage, and during these months the reserve supply will be drawn upon.

During these two months in any average year the run-off at the power site will be 1,200 sec.ft. From storage may be taken 1,100 acre-ft. per day for a period of 60 days, or a daily draw-down of 550 sec.-ft., making a total of 1,750 sec.ft. continuously available for power. On a 50 per cent load factor, which is probably during August and September, 3,500 sec.ft. may be drawn off for power purposes. Early fall rains often come in September, so it is doubtful if storage is necessary for an average of more than six or seven weeks annually.



HYDRAULIC features at Baker River involve some novel arrangements as shown in the accompanying illustrations. Due to peculiar economic conditions no special manifold design was warranted. The design adopted (1) was a perfectly blunt take-off between tunnel and penstocks, the only gradation being a slightly tapered nose at the center. Narrowness of the gorge in which the dam was built is indicated in (2), a downstream view. The close proximity of power house to dam is shown in (3). A finished inside diameter of 22 ft. is provided in the main pressure tunnel (4). Upstream view (5) of dam, showing intake.

Dam

The dam is of the semi-gravity arch type, built of mass concrete with a spillway through control gates along the crest of the dam. The upstream face of the dam is laid out on a radius of 250 ft. and the entire cross-section of the dam likewise is swung on the same center. The width of the river level is about 150 ft. and the length of the crest approximately 400 ft. The normal spill crest of the dam is at El. 393 and is divided into spillway sections 10 ft. wide in the clear. These sections are separated by piers 18 in. wide and 29 ft. high. These piers are slotted and fitted with 10 x 12-ft. gates which bring the maximum spill crest to El. 405. The gates are raised and lowered by a mechanical device which travels on the top of the piers. The gates can be kept open during the flood periods of the river and so operated during the low-

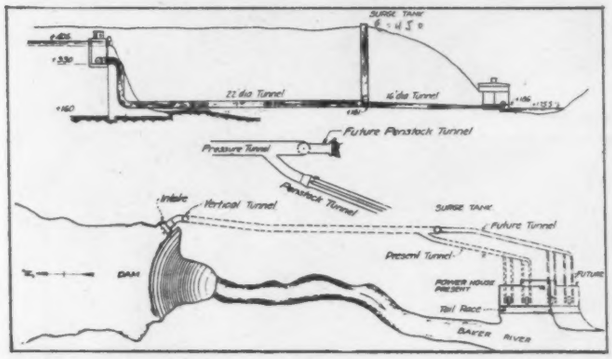


Fig. 1. Plan and sectional elevation showing the general scheme of development. Insert shows provisions for future extension made just below the surge chamber.

water period that the water in the reservoir may be conserved. The total height of the dam is 263 ft. from bedrock to the top of gate piers or 234 ft. to the spillway crest. The lower portion of the downstream face of the dam is constructed on a vertical curve of 106-ft. radius, which curve is tangent to the apron. The total width of the cross-section of the dam at the point of maximum depth, including the apron, is 180 ft.

The dam is located at the upper end of Baker River canyon, which is a gorge with nearly vertical sides over 300 ft. deep. The ridge through which the river has been cutting its way for ages is of limestone formation with occasional strata of shale. This formation provided excellent abutments. The bed of the stream is of solid limestone cut up more or less with pot-holes and ridges, the harder strata of limestone resisting erosion more than the softer rock. This effect resulted in a roughened condition of the stream bed and made possible an excellent bond with the footing of the dam.

Bedrock was found over the entire bottom of the dam at an average of 35 ft. below the bed of the river. Before excavation for the dam could proceed it was necessary to drive a diversion tunnel 17 x 24 ft. in cross-section from a point some 200 ft. above the upstream face of the dam to a point 300 ft. below the downstream face. The intake for the diversion tunnel was driven well below the bed of the stream so that when the final shot was made in the rock wall separating the tunnel from the river bed over two-thirds of the stream flow was diverted at once.

As soon as the diversion tunnel was placed in use the work of constructing the upstream cofferdam was begun. This structure was built of 10 x 10-in. timbers laced together both longitudinally and transversely to the stream. The crib work was divided into two portions. A double crib on the downstream side and single crib on the upstream side were filled with rock. The space in between the double cribs was puddled with clay, the puddle chamber first being lined with 2-in. planking. This whole arrangement made a very tight dam that successfully withstood several floods and made possible the pouring of concrete on the upstream portion of the dam. The downstream crib never was any more than a simple structure.

The downstream crib never was any more than a simple structure.

Once during the construction of the dam, the engineers received a severe setback to their plans due to a strike started by the I.W.W., one of their demands being a boycott on California fruit. Other demands of like character showed that the strike was simply an excuse to inflict damage on the power company. The bottom of the dam site had been uncovered and one or two pours of concrete had been made. The strike occurred just at a time when one more week's placing of concrete would have put the masonry well above the upstream cofferdam. It was a discouraging day when the strike conditions became such that it was necessary to pull the pumps and flood the cofferdam. This act on the part of the strikers cost the workmen several months of employment when work was scarce over the winter months and cost the job some four months' delay in completion of the dam. Notwithstanding this, however, the whole project was completed within the original time estimate.

An incident is mentioned just to show how often the plans of "mice and men gang aft agley." During the early stages of the construction work a pile trestle some 700 ft. long was thrown across the Baker River to connect the main workings with the sand and gravel plant. The plant and bridge were no sooner placed in operation than the worst flood in several years swept down the river and partially wrecked the bridge and at the same time put the river in a new channel. This necessitated rebuilding the bridge at a month's loss, thereby reducing the engineers' factor of safety in building time. The lost time, however, was made up during the later portion of the job. The gravel plant produced and the bridge safely carried over 250,000 cu.yd. of sand and gravel all of which was used in the construction of the dam, tunnel, power house and other works.

Tunnel Intake

Located on the east side of the canyon and adjacent to the upstream face of the main dam is the intake to the pressure tunnel. The gates controlling the inflow of water are protected by a bank of rack bars 50 ft. in width extending from the sill of

the gates at El. 330 to the floor of the gate house at El. 435. Motor-operated rakes are provided to remove accumulated trash. There are two gates each 12 ft. in width by 20 ft. in height made of plate steel faced with brass liners. These gates are raised and lowered by means of hydraulic cylinders operated by oil pressure supplied at 1,500 lb. per sq. in. through a Watson-Stillman high-pressure pump. One of the gates is so designed that it may be opened or closed under an unbalanced pressure. The other gate will be opened and closed only when the water pressure is balanced. Stop logs are provided in front of the gates for emergency use. The gates close the two intake openings which are roughly two halves of a circle separated by a concrete wall, and which merge into a single circular tunnel about 20 ft. back of the gates. The tunnel then turns directly downward to an intake shaft 22 ft. in finished diameter which goes to the bottom of the pressure tunnel. In order that the tunnel may be filled without opening the large gates, the 24-in. bypass gates are provided at El. 360.

Pressure Tunnel and Penstocks

From the intake shaft the pressure tunnel extends on through solid limestone formation to a circular forebay or surge chamber. The total length of tunnel is 890 ft. The tunnel was bored actually 24 ft. in diameter but has a finished inside diameter of 22 ft. The size of this tunnel is sufficient to carry water for four units at 10½ ft. per sec. based on total consumption of 4,000 sec.ft.

Beyond the surge chamber the tunnel extends some 50 ft. at a reduced section of 16-ft. diameter. This extension is to provide a connection for future units. A plug or seal is provided at the end of this extension to prevent leakage and to enable the completion of the rest of the tunnel beyond the seal at any time. In this way extension work for the future two units may be carried on at any time without interrupting operation of the present units.

About 65 ft. north of the surge chamber a branch tunnel takes off that also is 16 ft. in diameter. This tunnel extends some 230 ft. to a bell-mouth into which are sealed the four penstocks for the present two units. No attempt was made to obtain a particularly smooth transition from the 16-ft. tunnel to the four 8-ft. steel penstocks. The bell-mouth flare of the tunnel and a fairly blunt nose covering the cross-shaped concrete filler between the four pipes are the only attempts at smoothing out the flow line. It was believed that the additional construction investment necessary to provide a fully stream-line flow surface at the manifold was unwarranted. Figs. 1 and 2 indicate the construction methods and design used.

As noted above, the surge chamber is located at the lower end of and directly over the pressure tunnel. It is constructed through solid limestone with the exception of the top 50 ft. which is in heavy blue clay. The finished inside diameter is 20 ft. and the elevation at the top is 450. The surge chamber is only 500 ft. from the water wheels, giving most excellent hydraulic effects and reducing the tunnel and pipe line losses to a minimum.

There are two penstocks to each unit. Each penstock is 8 ft. in diameter throughout its length except for a short taper section immediately ahead of the turbine scroll case. At this latter point the

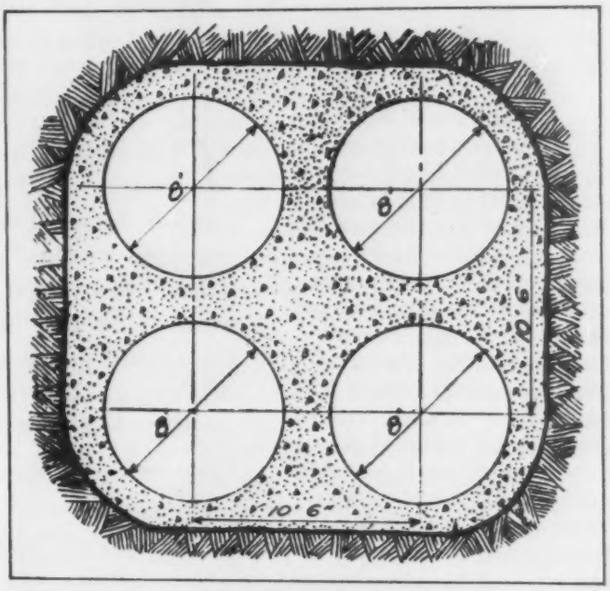


Fig. 2. Sectional view of the penstock tunnel at the point of transition between the circular section and the four penstocks.

section is reduced to 7 ft. and an 84-in. Allis-Chalmers butterfly valve fitted. The penstocks open directly into the tunnel, there being no gate on the upstream end of the pipe lines. Penstock sections were made in 15-ft. lengths to facilitate handling during construction. All circular joints are single-riveted lapped joints while all longitudinal seams are triple-riveted lapped joints. One-inch button-head rivets were used throughout, the thickness of metal being ½ in. through the entire line. The 1,400 ft. of penstock pipe was supplied by the Puget Sound Machinery Depot of Seattle.

In order to maintain the seal of the draft tubes, the minimum elevation of the surface of the tail water will be 175.5. This will give a gross head of 229.5 ft. when the reservoir is full and 184.5 ft. at maximum draw-down of the reservoir.

Such information as can be obtained from observers and from high-water marks in the canyon indicate that extreme floods may raise the water in the river, at the power-house site, up to El. 200. Of course the erection of the dam and power house will provide means of regulating the flow of the river to a considerable extent, but the walls of the power house are being constructed with a view to resisting floods up to El. 203.5.

The construction of the Baker River project was under the direction of the Division of Construction and Engineering of Stone & Webster, Inc. In this division S. L. Shuffleton is Western manager, G. P. Jessup superintendent of construction, W. F. Brown assistant superintendent of construction, L. D. Zimmerman, construction engineer, L. N. Robinson, electrical engineer, W. L. Richardson, structural engineer, and the writer is general superintendent.

The Baker River Development

A Discussion of the Electrical Features

By L. N. Robinson
Electrical Engineer, Stone & Webster, Inc., Seattle

THE Baker River development of the Puget Sound Power & Light Company is the outstanding power project of the year in the Pacific Northwest. A 40,000-kva. power house, two important substations and 66 miles of 110-kv. transmission line all are integral parts of this project. Its completion brings a new power source into a growing district.

HYDROELECTRIC power supply in the Pacific Northwest is augmented to the extent of 39,000 kva. by the completion of the initial installation at the Baker River station of the Puget Sound Power & Light Company. Load growth throughout the company's system and particularly in the northern districts necessitated power development on the northern end of that system. Thus Baker River will carry the northern end of the system and relieve the southern generating plants of that burden and make available their power for the growing load in Seattle and environs. Further, power purchase from Canada will be discontinued upon the expiration of the present contract next April. Thus the advent of this additional power effects somewhat of a shift in the "center of gravity" of Northwest power.

The entire scope of the development includes the generating station, 66 miles of 110-kv. transmission line, 22 miles of 66-kv. transmission line, two major substations and, of course, the hydraulic development, which is described in another article.

Building and Equipment

Built of reinforced concrete, the power house is designed to house all of the electrical equipment with the exception of the lightning arresters, which are located upon the roof. The third and fourth floors of the building carry the heavy switching apparatus and hence they contain some structural steel beams. The present building is 154 ft. 6 in. long, 98 ft. wide and 87 ft. 4 in. high from the basement floor to the ridge of the roof. Complete provisions have been made to care for a 112 ft. 6 in. extension of the building to accommodate further generating capacity.

In the basement just in the rear of the waterwheel foundations are located the oil-pump rooms, oil-storage rooms, generator rheostat rooms, and neutral switch room. Generating units, exciters and transformer bays occupy the first floor. The second floor carries the main switchboard room, the office and the 6.6-kv. bus, while the third floor contains the battery room, 6.6-kv. switch room, two small instrument rooms, a storage room and locker room. The fourth floor is given over to 110-kv. buses, switches and instrument transformers. Twin housing structures on the roof cover the 110-kv. potential transformers and their fused disconnecting switches. Adjacent to these housings are the lightning arrester racks and the steel structures from which the lines take off. A 75-ton Niles crane with a 10-ton auxiliary hook and 4-motor drive spans the generator room 35 ft. above the floor. The general arrangement of the building and its equipment is shown in Figs. 1 and 2.

Furnishing the motive power for each of the two generators are double-overhung, Allis-Chalmers, Francis-type, horizontal turbines. Each wheel is rated at 10,000 mechanical horsepower when operating under an effective head of 200 ft. and at 300 r.p.m. Two of the interesting features of the double-overhung unit are the elimination of the shaft through the discharge elbows and the improved accessibility to the runners for inspection and repair purposes.

Each generating unit is equipped with an Allis-Chalmers oil-operated governor which is belt-driven from the horizontal shaft of the unit and controls both of the waterwheels of the unit. No relief valves are necessary because of the proximity of the surge chamber to the turbines.

Main Generators

The two G. E. generators are each rated at 19,500 kva., 15,600 kw., 0.8 power factor, 6.6 kv., 3 phase, 60 cycles, 24 poles, 300 r.p.m.

Turbine runners are bolted directly to hubs forged on each end of each generator shaft. Each complete rotating element, including generator rotor, shaft and two turbine runners, weighs 70 tons and is supported by two 17 x 34-in. water-cooled bearings. The bearings operate normally with ring oiling, but are provided with pressure oil supply for use during starting and stopping periods.

The rotor is equipped with an amortisseur winding and speed switches for use in automatic synchronizing. While the machine is coming up to speed the operator can turn a key on the switchboard which prearranges the switch-control circuits. Once this is done the generator oil switch automatically will connect the generator through its transformer bank to the system as soon as the speed reaches 95 per cent of normal. This is done with the field circuit of the generator open. The induction-motor effect of the squirrel-cage winding brings the unit nearly up to synchronous speed. The field switch is closed automatically a few seconds after the main oil circuit breaker closes and as the field builds up the generator is pulled into

synchronism. The operator then adjusts the field current for the voltage and power factor conditions desired.

In case a generator is thrown out of synchronism due to sudden interruption of its load and the speed rises above normal, the machine also may be resynchronized automatically since the speed switch opens when the speed exceeds 105 per cent of

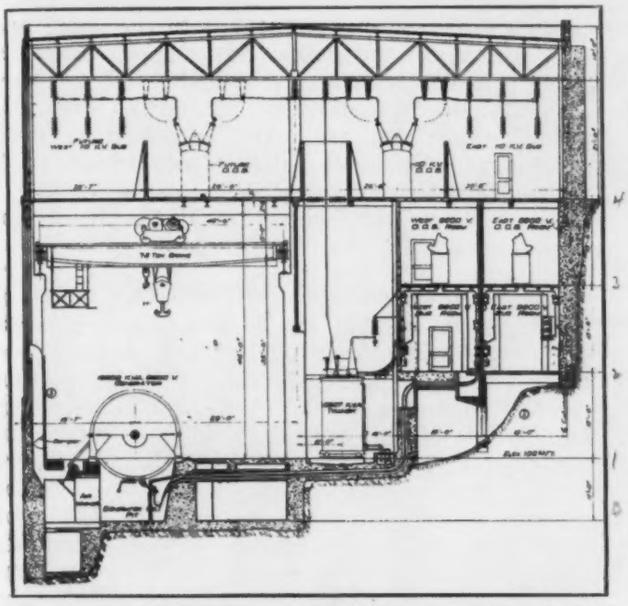


Fig. 1. Transverse section through main generator and 110-kv. transformer indicating the course of the electric circuits from the generator to the high-tension bus.

normal. By turning the automatic synchronizing key the operator can arrange for the machine to be synchronized automatically as soon as the speed comes down to within 5 per cent of normal. It is expected that these automatic features will expedite considerably the resumption of service after interruption, as well as reduce the number of attendants required.

This system of synchronizing has been used extensively in connection with the operation of automatic stations, but there is no record of cases where it has been used in synchronizing units as large as the Baker River units, nor units comprising so large a percentage of the total generating capacity of a system.

Leads from both ends of the stator winding are brought out of the stator frame to accommodate the introduction of current transformers for differential protection of the generators before making up the generator neutral. Each generator is grounded through a non-automatic oil circuit breaker. In case of a short circuit or ground in the generator or in its main cables the differential relays automatically disconnect the generator from its load, open the generator field switch, shut down the turbine and sound the station alarm.

Temperature coils are embedded in the slots against the insulation of the main coils of each generator. The temperature indicating instruments are mounted on the switchboard. Temperature relays sound an alarm if the temperature of the generator exceeds a predetermined limit. This is especially useful during system trouble when it is desired to overload a machine to the limit for a short time. These relays can be made to shut down the machine or to disconnect successive outgoing lines when the temperature reaches the limit. However, it hardly seems advisable to make use of these facilities in the case of the Baker River station, at least for the present.

Air required for cooling the generators amounts to 47,000 cu. ft. per min. per generator. This air is drawn through openings in the river wall of the building 17 ft. above the generator room floor line and down through ducts to the basement where it passes through a Sprayco air washer at the entrance to each generator pit. Air washers are deemed especially necessary at this plant because of the proximity of the large cement mill at Concrete, less than a mile away, and the consequently large amount of dust always in the air.

Since the generators are totally enclosed by the frames and end shields which cannot be removed instantaneously, each generator is fitted with perforated fire-extinguisher piping inside the end shields at both ends. This piping is connected to the station water supply through suitable valves and drains to prevent water entering the generators unless needed.

Exciters

Since the main generating units have the double-overhung turbines without shafts extending beyond the runners at either end, it is out of the question to employ direct-connected exciters for the individual units. Each of the main generating units requires 100 kw. of excitation. The station crane is operated with direct current supplied from the exciter buses. The high-pressure bearing-oil pump also is supplied from the exciter buses so that the main generating units can be started up without the aid of any source of electric power outside the station itself.

Two 500-kw., 250-volt, compound, interpole, horizontal Westinghouse exciter units are installed to operate at 875 r.p.m. Each exciter is large enough to excite four 19,500-kva. main generating units and to handle the station crane and high-pressure oil pump in addition.

Each exciter is coupled to a 750-hp., 6.6-kv. squirrel-cage induction motor. One unit also is equipped with a 720-hp. Francis-type turbine which may be used instead of the motor when desired. The shaft of the other exciter is suitable for connecting a similar turbine in the future if desired. The water-wheel drive will be used normally.

Main Transformers

Each of the two main transformer banks consists of three General Electric 6,667-kva., 6.6/63.5-110 kv. (Y), oil-insulated, water-cooled transformers. The transformers are connected delta on the low-voltage side and star on the high-voltage side. It is planned to operate with the neutrals grounded on the high-voltage side.

The transformers are equipped with 4½ per cent over-voltage taps on the high-voltage side to compensate for internal voltage drop, particularly when operating with low-power-factor load. This is done so that normal voltage can be maintained on the high-tension bus without seriously over-exciting the generators. Since the transformers are furnished with oil conservators they also are equipped with

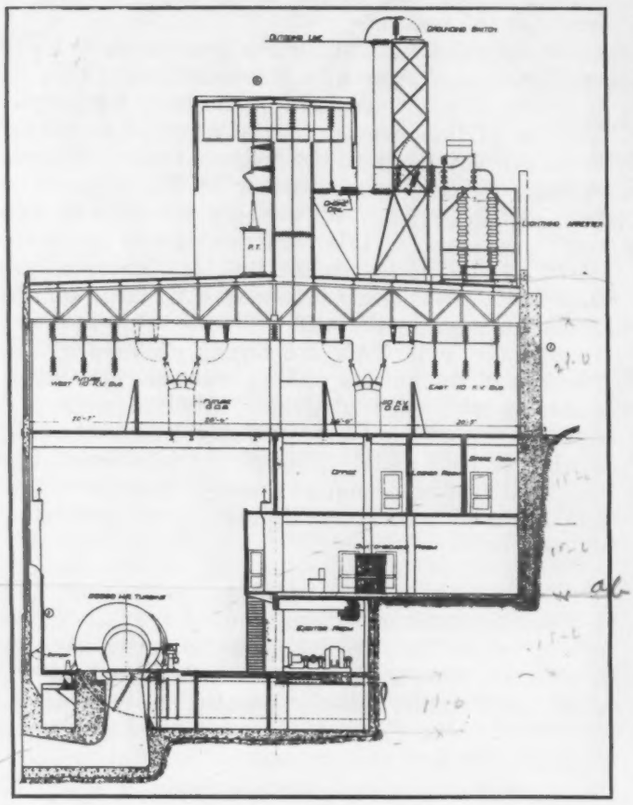


Fig. 2. Transverse section through exciter room and outgoing line position indicating the electrical circuits from the high-tension bus to the outside line.

ratio adjusters so that taps may be changed without breaking the oil-tight joints at the manholes on the top of the transformer tanks.

Temperature coils embedded in the windings operate indicating instruments on the main switchboard. A thermometer with alarm contacts also is provided on each of the transformers. Differential relays open the oil circuit breakers on both the high-tension and low-tension sides in case of trouble inside the transformers. These relays function in response to unbalances in the current in the respective phases on the two sides of a transformer bank.

The transformers are provided with flanged wheels on standard railroad track gage of 56½ in. This happens to be especially useful since the short private railroad to the power house passes under a highway bridge with a clearance that did not permit taking the transformers through on even the lowest type of flat car. The transformers were taken down this track on their own wheels with the help of a locomotive crane.

Fig. 3 shows the general arrangement of apparatus on the first floor.

Bus Arrangement and Switching Equipment

A single 6.6-kv. bus can be fed from either or both of the main generating units. Normally this bus will be used principally to supply the station service transformers and the exciter motors. The main output of the generators will go directly to their respective transformer banks without passing through the low-tension bus. The bus will be of adequate capacity, however, so that the output of either generator can be transferred to either transformer bank in case of emergency. Future generators probably will not be connected to this bus. As indicated in Figs. 1 and 2 the 6.6-kv. bus is back of the transformers on the second floor. This location reduced the amount of excavation necessary and also aided in making full use of the building height required for crane and high-tension clearances.

The ultimate development of the station contemplates two 110-kv. buses. Only the necessary part of the first of these and the connections for the bypass air-break switch are installed at present. Reference to Fig. 5 will show the scheme of electrical connections including the substations.

The main generator oil circuit breakers are of General Electric manufacture and have 2,000 amp. continuous carrying capacity and a 100,000-amp., 5-sec. carrying capacity. Each has a guaranteed

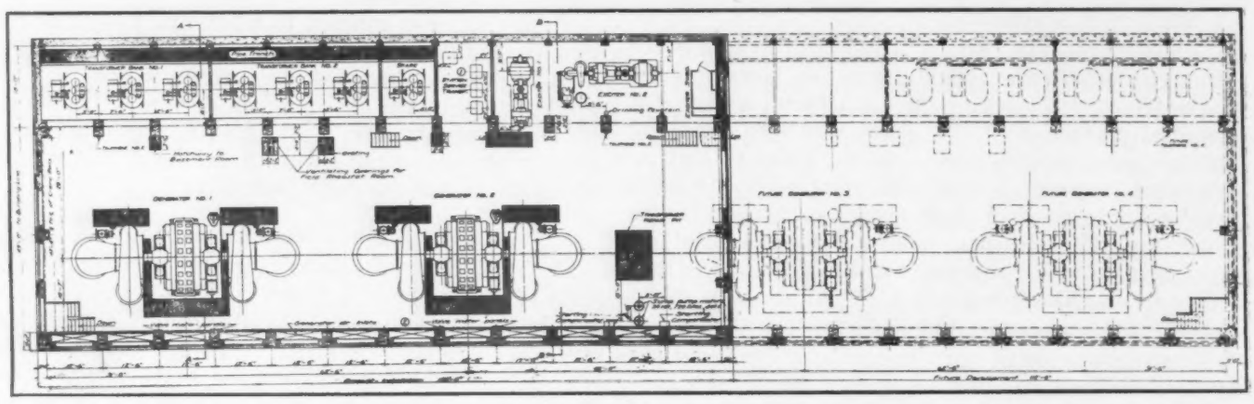
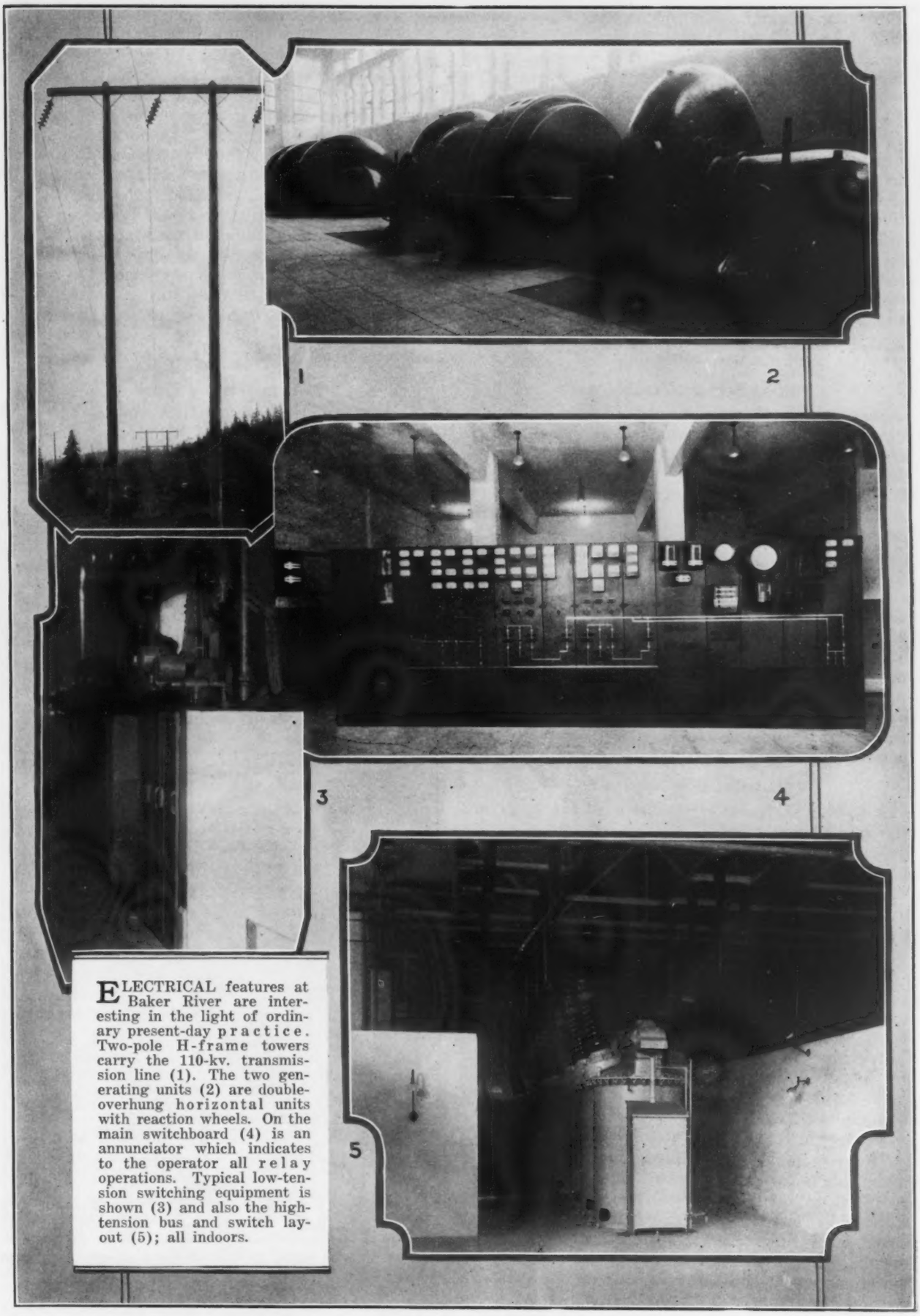


Fig. 3. Generator floor plan. This shows the relative positions of generators, transformers and exciters and indicates the contemplated future addition to the power house.



ELECTRICAL features at Baker River are interesting in the light of ordinary present-day practice. Two-pole H-frame towers carry the 110-kv. transmission line (1). The two generating units (2) are double-overhung horizontal units with reaction wheels. On the main switchboard (4) is an annunciator which indicates to the operator all relay operations. Typical low-tension switching equipment is shown (3) and also the high-tension bus and switch lay-out (5); all indoors.

rupturing capacity of 52,000 amp. at 6.6 kv. based on the OCO plus OCO duty cycle. The oil circuit breakers for the 6.6-kv. station service and exciter motor circuits have a 1,200-amp. continuous carrying capacity and a guaranted rupturing capacity of 52,000 amp. at 6.6-kv. Normal loads on the latter circuit breakers will not exceed 100 amp., but it was necessary to purchase 1,200-amp. breakers in order to obtain the necessary 5-sec. and 1-sec. carrying capacities, namely 60,000 and 100,000 amp., respectively.

The 110-kv. oil circuit breakers for the transformer banks and transmission line have a 400-amp. continuous carrying capacity and guaranteed rupturing capacity of 5,500 amp. at 110-kv. with 5-sec. and 1-sec. carrying capacities of 20,000 and 40,000 amp., respectively. The net weight of each of these breakers complete with oil is 52,400 lb.

Station Service Transformers

Station power service is supplied from a bank of three Westinghouse 200-kva., self-cooled transformers stepping down from 6.6 kv. to 440 volts, 3 phase. These supply the auxiliary motors in the station, headgate motors, shop equipment and general power requirements except the crane motors and bearing-oil pumps.

For lighting the station a similar 200-kva. transformer will be installed to step down from 6.6 kv. to 110/220 volts, single phase. It is not expected that the station lighting load will approach 200 kw., but interchangeability between the station light and station power units is desirable in case of breakdown in any one of the units. Since the station power transformers will be connected delta-delta, one of them can be used to replace the station lighting transformer if that should fail, leaving the power bank operating open-delta temporarily.

Miscellaneous Apparatus

A 60-cell Exide battery is installed for supplying the oil-switch control circuits. This battery also supplies emergency lights in the station to provide illumination in case of failure of the alternating current. The storage battery is charged by an induction-motor-driven charging set floated across the battery at all times except during interruption of the a.c. supply.

Two Westinghouse vibrating-relay-type voltage regulators are installed for automatically regulating the voltage of the main generators. One of these is connected to each of the 500-kw. exciters. Since the estimated range of exciter voltage is from 60 to 250 volts, the regulators will be energized from the storage battery. The regulators are mounted on the main board in the control room which overlooks the generator floor.

Three separate switchboards are installed. The main switchboard is in the switchboard room on the second floor. This switchboard controls the 6.6-kv. and 110-kv. circuits and the exciters. The switchboard is of the straight, vertical-panel type with the indicating instruments and control switches on the front panels and the watthour meters and relays on slate panels in the rear. This leaves the usual wiring alley between the two boards. The relay equipment is General Electric, and all indicating instruments are Weston. One of the features of the switchboard is an annunciator on a central panel opposite the operator's desk. This annunciator shows every relay operation and indicates the nature of the trouble causing the operation. The station clock on the switchboard is provided with a Warren synchronous-motor attachment for use in regulating frequency.

The station service switchboard is located in one end of the main switchboard room and at right angles to the main switchboard. This board contains a 440-volt, 3-phase station power panel; 110-220-volt station lighting panel and the storage-battery panel. The generator field control and exciter switchboard is on the first floor near the exciters and is remotely controlled from the main switchboard.

Transmission Lines

The 110-kv. transmission line consists of three No. 4/0, 7-strand, hard-drawn copper conductors supported by Locke suspension insulators on wooden

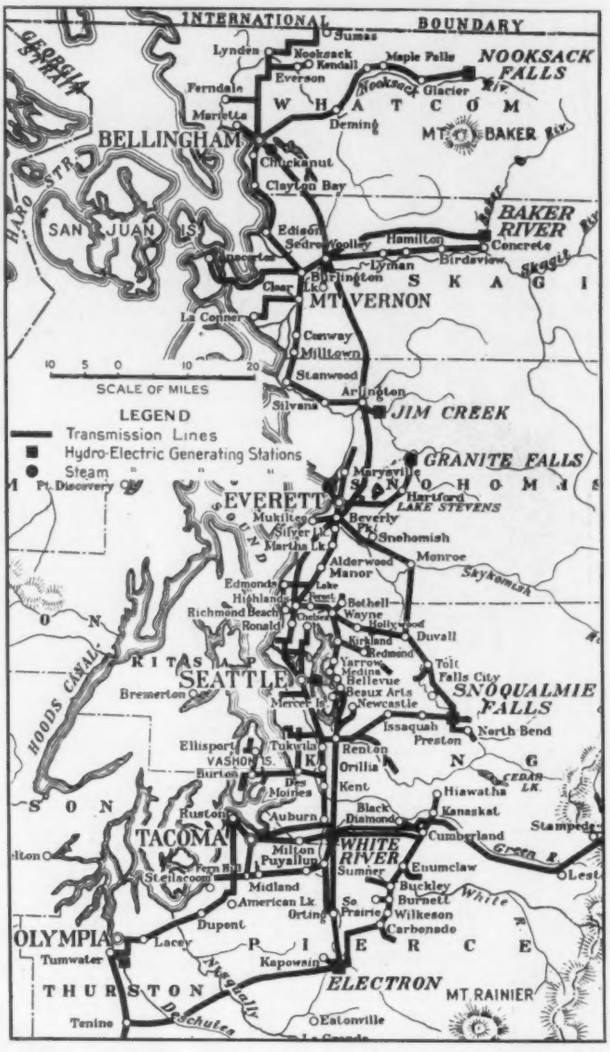


Fig. 4. Map of major portion of the transmission system of the Puget Sound Power & Light Company showing the location of the Baker River station with respect to the rest of the system.

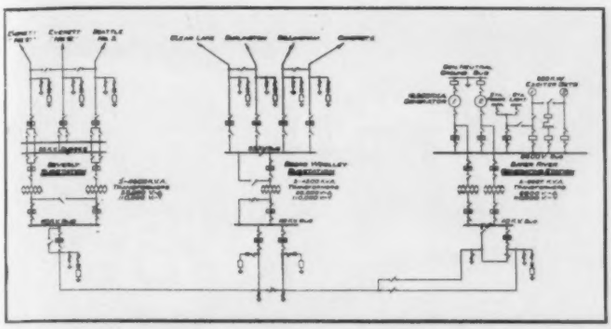


Fig. 5. Single-line wiring diagram of the initial installation at Baker River station, Sedro-Woolley substation and Beverly Park substation.

H-frame towers. The spans average 450 ft. in length and the conductors are strung on 11-ft. 6-in. centers. Steel towers are used only for crossing the Skagit and Snohomish Rivers. The length of the line from Baker River station to Sedro-Woolley substation is approximately 23 miles and from Sedro-Woolley substation to Beverly substation 43 miles.

From Sedro-Woolley a new 55-kv. line furnishes additional service to Bellingham. This line consists of three No. 4/0 stranded-copper conductors arranged in an equilateral triangle with 7-ft. spacings and carried on "Pinco" pin-type insulators. Wooden poles are used throughout the 22 miles of line with spans averaging 300 ft. in length.

Substations

Both the Sedro-Woolley and the Beverly substation are of the outdoor type with only the switchboards and auxiliaries installed in the respective buildings. These buildings are of reinforced concrete, each two stories high.

At both of these substations the switchboards are on the second floor so that the operators may have a clear view overlooking all of the outdoor equipment. The storage batteries, charging sets, shops, storerooms and miscellaneous auxiliaries are on the ground floor. The Sedro-Woolley building has incorporated in it a tower with a crane for use in untanking transformers. Trucks with heavy loads also can be driven directly into this building and unloaded.

Since the Beverly substation building later on will be extended to house synchronous condensers and then will be equipped with a traveling crane, a temporary steel tower with electric hoist has been erected outdoors. This tower spans the railroad spur which connects with the Pacific Northwest Traction Company. Thus the crane was available for unloading cars during construction. Transformers also can be rolled under it for untanking.

Outdoor equipment at each substation is supported on reinforced concrete slabs. Latticed structural steel columns and trusses support the wiring and the disconnecting switches. To obtain proper mechanical strength and rigidity as well as conductivity, the buses are all of 1-in. iron pipe size copper tubing. The bus conductors are carried on Locke suspension insulator strings and pedestal-type insulators with as few dead-end strain spans as are practicable.

The 110-kv. line from Baker River goes right across the rear of the Sedro-Woolley station property. The line is double dead-ended at a structure on the property and looped through the station bus. A Pacific Electric air-break, pole-top switch mounted on the dead-end structure makes possible the complete by-passing of this station. An oil switch in each side controls the two branches of the line when it is looped through the station. The line terminates at the Beverly substation bus.

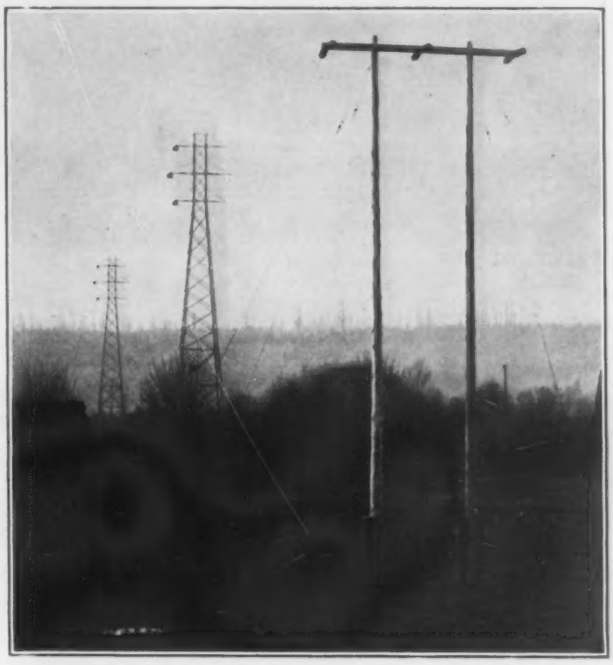
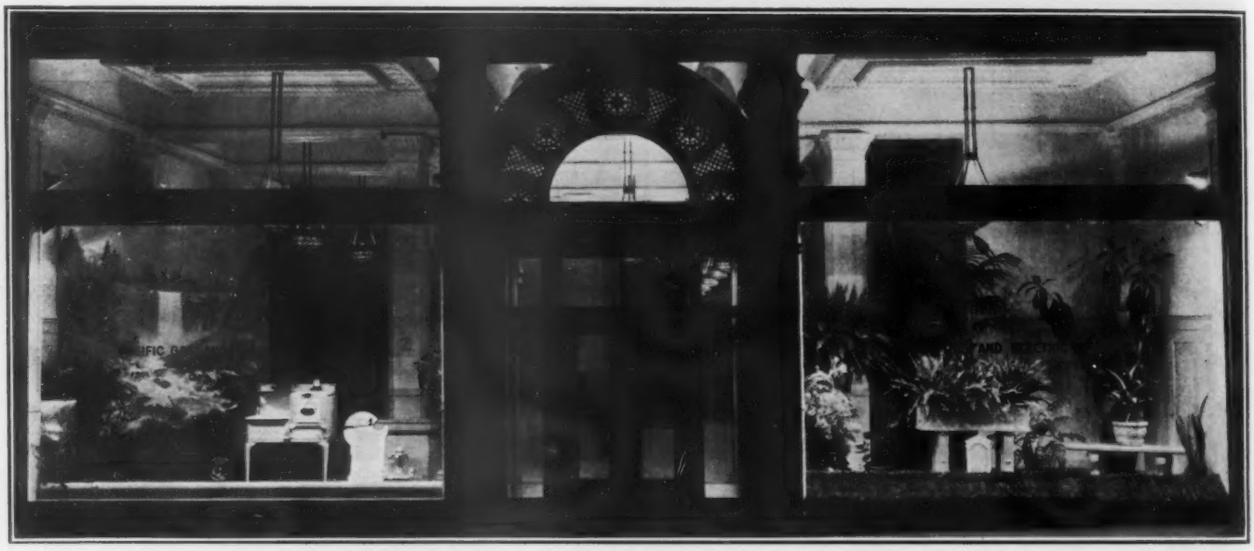


Fig. 6. Baker 110-kv. line crossing Snohomish River.

Unique Features

The outstanding feature of the power-house end of this project is the long list of factors which made the power site so nearly ideal and which tended to facilitate its economical development. Some of the more prominent of these factors are:

1. Glacial water supply supplementing heavy rainfall.
2. Reservoir site totally enclosed except at inlet and at outlet.
3. Dam site in narrow rock-walled gorge.
4. Tunnel only long enough to remove station from dam.
5. Tunnel through tight rock.
6. Cement mill less than mile from building site.
7. Gravel pit in lower end of reservoir site.
8. Concrete warehouses of abandoned mill on the property.
9. Common-carrier railroad a half mile from the power station.
10. Incorporated town across river from project.
11. Paved state highway through workings.
12. Less than twenty-five miles to tidewater.
13. Potential markets for power all along transmission line.



High-intensity illumination is used in these windows of a California power company.

High-Intensity Illumination of Power Company's Windows

THE last word in show-window lighting of high intensity and variety of color, spot lighting and foot lighting is now on exhibition day and night at the office of the San Francisco Division of the Pacific Gas and Electric Company. Here the public may see how electrical illumination can be made to compete with daylight.

Commenting upon this installation and its purpose one of the executives of the San Francisco Division of the company stated: "To demonstrate and reveal to all retail merchants and their customers the dollar-and-cents value of properly utilizing, controlling and directing the illumination in their show windows and stores, the company recently has completed the most modern installation of window lighting anywhere in the country west of Chicago."

These two windows are dedicated to and are offered for use to the customers of the company as an added opportunity to display merchandise sold in their own place of business, and to permit the merchant to see his own merchandise properly illuminated and displayed. In this way the merchant may realize fully the positive ability of light to create sales appeal, and to see what correct illumination can do.

An astounding advance in a knowledge of the science of illumination for every possible purpose has been accomplished by illuminating engineers in the last ten years. It is said that ninety per cent of retail sales are completed through vision. It becomes necessary then that merchandise should be shown properly illuminated to aid vision.

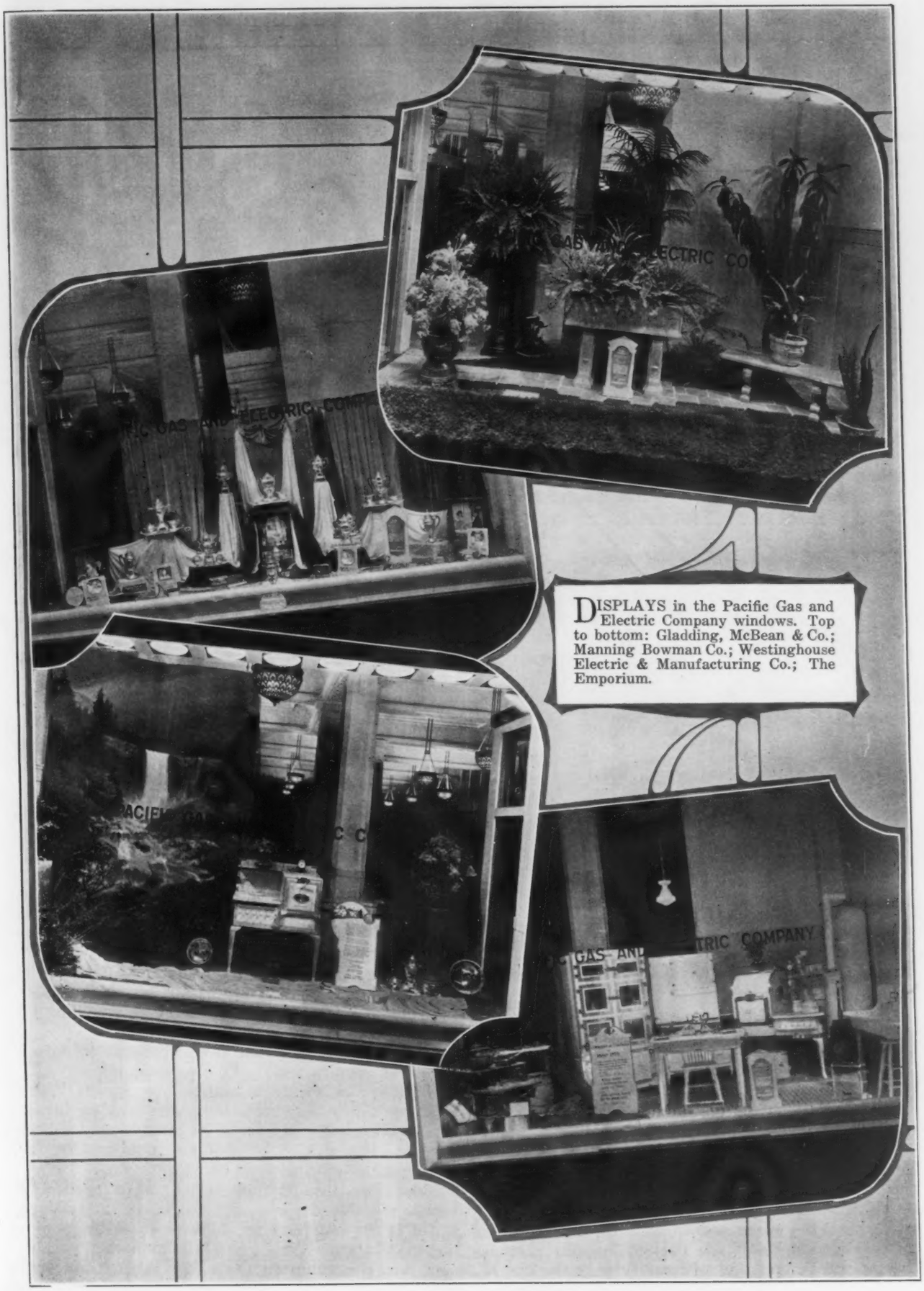
Correct and proper illumination for show-window and store lighting accomplishes the following desirable conditions:

1. Adds attractiveness and value to merchandise displayed.
2. Permits closer and more accurate inspection of goods, thereby reducing the number of exchanges.
3. Saves rent for the store in the middle of the block by enabling it to compete with the corner store without having to change its location.
4. Attracts trade from the poorly lighted store.
5. Creates a silent salesman after closing hours by serving "window shoppers."
6. Overcomes daylight reflections.

The overcoming of daylight reflections in display windows has long been a problem to store managers and illuminating engineers. It has been found that the more intense the light distributed properly on the display both day and night, the less will be the reflections in the plate glass windows. People on the streets in the daytime are shopping, and that is the time to draw them into a store.

Overcoming reflection was accomplished in this installation by the use of 500-watt lamps on 18-in. centers in X-Ray reflectors and housing mounted on the transom bar at the top of the windows, 500-watt X-Ray floodlighting units with color mediums installed in the corners and in the ceiling in each of the windows, and X-Ray disappearing footlights with 100-watt lamps on 6-in. centers. Alternate lamps in the main battery of lamps and also in the footlights are placed on alternate circuits; and each spot-light is controlled separately. The detailed electrical layout is shown in the accompanying diagram. The windows also are equipped with water, gas, compressed air, and drainage connections.

The first display to be placed in the larger window was made by the Westinghouse Electric &



DISPLAYS in the Pacific Gas and Electric Company windows. Top to bottom: Gladding, McBean & Co.; Manning Bowman Co.; Westinghouse Electric & Manufacturing Co.; The Emporium.

Manufacturing Company. An oil painting 8 ft. wide and 11 ft. high of a mountain scene formed a beautiful background for the display. A little to one side in front of this was an illuminated picture of a hydroelectric power plant. In the center of the rest of the display was an all-white enamel Westinghouse electric range. In addition to this there was a number of smaller appliances shown, including an electric toaster, coffee urn, iron, and small air heaters. The attention of the onlooker was drawn to the various appliances by high-intensity "spotlighting" illumination, color effects, and distribution of light.

Table I. Window Checks on Various Stores on Sutter Street in the vicinity of the Pacific Gas and Electric Company. Afternoon: Weather Clear and Warm.

Store	Display	Time	Passed	Stopped	Perct'g Stopped
1.	Furniture	3:10 to 3:20	137	19	13.9
2.	P. G. E. (1) El. Kitchen	3:45 to 3:55	139	52	37.4
3.	P. G. E. (2) Chocolates	3:45 to 4:05	105	33	31.4
4.	Pack Drugs	4:08 to 4:18	151	9	6.0
5.	Toilet Art., Ftn. Pens	4:22 to 4:32	123	5	4.1
6.	Elect. Ranges	4:34 to 4:44	131	3	2.3
7.	Gas Ranges	4:34 to 4:44	131	3	2.3

The westerly window was equally attractive and beautiful. Gladding, McBean & Company created the display in this window, which consisted of gar-

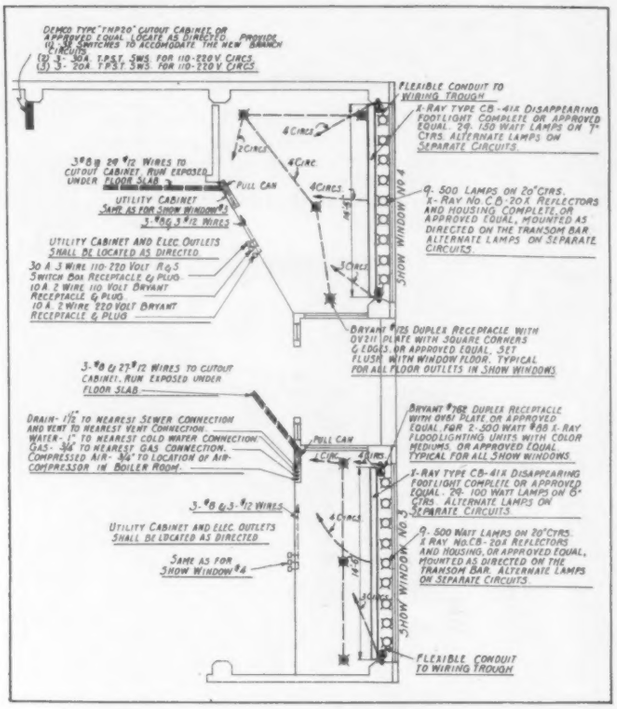

FLEXIBLE CONDUIT TO WIRING TROUGH
X-RAY TYPE CB-41X DISAPPEARING FOOTLIGHT COMPLETE OR APPROVED EQUAL. 29-150 WATT LAMPS ON 7" CTRS. ALTERNATE LAMPS ON SEPARATE CIRCUITS.
9-500 LAMPS ON 20" CTRS. X-RAY NO. CB-20X REFLECTORS AND HOUSING COMPLETE, OR APPROVED EQUAL, MOUNTED AS DIRECTED ON THE TRANSOM BAR ALTERNATE LAMPS ON SEPARATE CIRCUITS.
SHOW WINDOW NO. 4
UTILITY CABINET AND ELEC. OUTLETS SHALL BE LOCATED AS DIRECTED
BRYANT #725 DUPLEX RECEPTACLE WITH OV211 PLATE WITH SQUARE CORNERS & EDGES, OR APPROVED EQUAL, SET FLUSH WITH WINDOW FLOOR. TYPICAL FOR ALL FLOOR OUTLETS IN SHOW WINDOWS
DRAIN- 1½" TO NEAREST SEWER CONNECTION AND VENT TO NEAREST VENT CONNECTION
WATER- 1" TO NEAREST COLD WATER CONNECTION
GAS- ¾" TO NEAREST GAS CONNECTION.
COMPRESSED AIR- ¾" TO LOCATION OF AIR-COMPRESSOR IN BOILER ROOM.
BRYANT #762 DUPLEX RECEPTACLE WITH OV61 PLATE OR APPROVED EQUAL FOR 2-500 WATT #66 X-RAY FLOODLIGHTING UNITS WITH COLOR MEDIUMS, OR APPROVED EQUAL TYPICAL FOR ALL SHOW WINDOWS.
X-RAY TYPE CB-41X DISAPPEARING FOOTLIGHT COMPLETE OR APPROVED EQUAL. 29-100 WATT LAMPS ON 6" CTRS. ALTERNATE LAMPS ON SEPARATE CIRCUITS.
9-500 WATT LAMPS ON 20" CTRS. X RAY NO. CB-20X REFLECTORS AND HOUSING, OR APPROVED EQUAL, MOUNTED AS DIRECTED ON THE TRANSOM BAR. ALTERNATE LAMPS ON SEPARATE CIRCUITS.
SHOW WINDOW NO. 3
FLEXIBLE CONDUIT TO WIRING TROUGH

Fig. 1. Floor plan showing window lighting layout specified for the Pacific Gas and Electric Company.

den furniture of glazed and unglazed pottery as a series of settings for an extensive showing of foliage of different sizes, colors and forms.

During Diamond Jubilee week in San Francisco The Emporium put in a display showing a contrast between the kitchen of 1850 and that of 1925 with its electric range, water heater, air heaters, refrigerator, and the other modern electrical conveniences.

Other customers of the Pacific Gas and Electric Company will have an opportunity to make use of these windows to enable them to ascertain in a practical way the value of proper illumination.

Some interesting checks already have been made on passersby that prove conclusively the value of high-intensity illumination. The first of these was made on a Saturday afternoon between 2:30 and 3:00 p.m. During this half hour 123 people passed the window; of this number 79 or 64.2 per cent, stopped to look in one or both of the windows. Tables I and II show the results of additional checks on these windows and also on windows of other merchants on the same street.

Table II. Window Checks on Various Stores on Sutter Street in the vicinity of the Pacific Gas and Electric Company. Morning: Weather Clear and Warm.

Store	Display	Time	Passed	Stopped	Perc'tg Stopped
1.	Furniture	9:55 to 10:05	80	1	1.3
	Furniture	11:28 to 11:38	137	12	8.8
2.	P. G. E. (1) El. Kitchen	10:41 to 10:51	137	33	24.1
3.	P. G. E. (2) Chocolates	10:31 to 10:41	127	25	19.7
4.	Pack Drugs	11:05 to 11:15	147	0	0.0
5.	Toilet Art., Ftn. Pens	11:16 to 11:26	75	2	2.7
6.	Elect. Ranges	10:17 to 10:27	133	3	2.3
7.	Gas Ranges	10:17 to 10:27	133	3	2.3
8.	Elec. Goods	10:52 to 11:02	134	1	0.7
9.	Ladies' Wear	9:55 to 10:05	144	14	9.7
10.	Furniture	9:55 to 10:05	70	17	24.3
11.	Candies	10:23 to 10:33	79	23	29.1
12.	Ladies' Wear	10:10 to 10:20	93	21	22.6
13.	Furniture	10:38 to 10:48	52	6	11.5
14.	Market	10:51 to 11:01	84	5	6.0
15.	Picture Frame	11:10 to 11:20	39	1	2.6
16.	Hats and Dresses	11:10 to 11:20	77	19	24.7
17.	Furniture	11:26 to 11:36	48	3	6.3

The windows already have produced splendid results. Representatives of two large concerns with their architects have called on the power-company officials to go over the details of the installation in order to plan similar installations correctly.

Pumping Crude Petroleum by Electricity

By C. R. Powell
Westinghouse Electric & Manufacturing Company

WHEN electric equipment first was used for pumping oil wells there was a tendency to use existing standard motors and controllers, little consideration being given to the actual conditions under which the apparatus would have to operate. Consequently, some of the operations in connection with sufficient satisfaction to effect an appreciable movement toward the general use of electricity in this work. This led to a detailed study of the actual requirements and to a succession of developments all leading toward perfection in the design of an oil well pumping motor and its controller.

A well producing crude petroleum has a variety of power requirements. The actual pumping duty is light or moderate at fairly low speeds. The cleaning and pulling operations are heavier duties, most economically performed at considerably higher speeds. Power also is required occasionally for short periods of time for pulling casing.

Since the power requirements for a producing well as mentioned above vary so greatly, a standard motor is not satisfactory. In some cases the pumping motor is of one size and is connected permanently to the pump on the well. When additional

power is required for cleaning and baling the well a larger motor must be installed for this duty. This method is uneconomical as it requires the use of two motors, and to secure a more economical unit the double-rated motor was designed for this work.

This motor can operate at two different speeds. At the low speed the horsepower is low since pumping is performed at the low speed; on the high speed rating the motor has a high horsepower capacity, which is used for the pulling and cleaning operations. High efficiency and economy thus are obtained on each of these operations, which differ widely in scope.

An important auxiliary of the double-rated motor is a special controller to obtain the different speeds and horsepowers. This control unit is unique in that when it is delivered at the well only a few simple connections need be made to the motor in order to place it in service. All complicated connections are made at the factory, leaving only a few simple final connections which can be made by even the most inexperienced electrician.

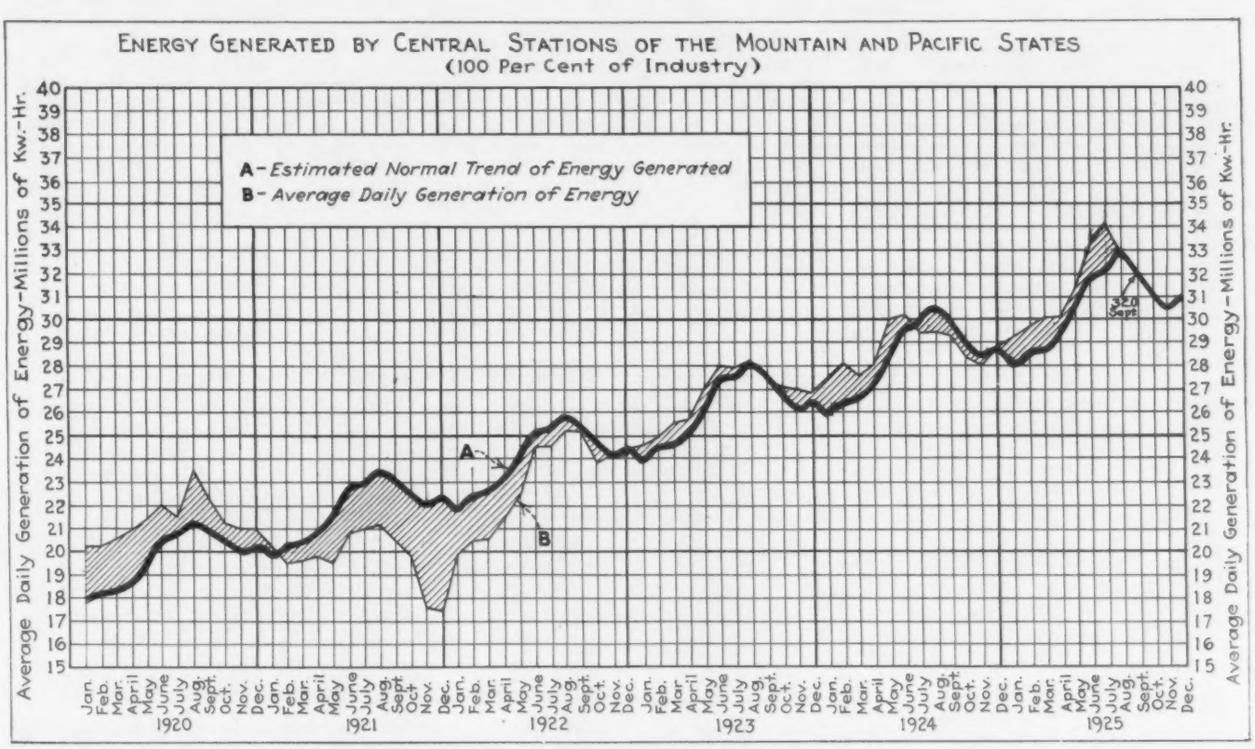
In pumping shallow, moderately deep, and light producing wells the unit pumping power has been found entirely satisfactory. In locations where the surface area is valuable, such as in towns, cultivated fields, and in isolated or inaccessible locations, such as river beds, it is particularly adaptable. Under such conditions the motor-driven unit is the cheapest and safest means of pumping because of its low first cost, low operating and maintenance cost, and absence of fire risk.

The operation of pumping jacks by means of pull rods from a central power head has been practiced to a large extent in some parts of the United States. The electric motor is especially suitable for driving these power heads. Minimum production cost is obtained, and one man can take care of many wells. The upkeep and operating costs are low, in many cases negligible, and the wide range of motor sizes available makes its possible to obtain the most efficient equipment for any installation, regardless of the number of wells to be pumped.

Industry Operating at Normal in September

FOR the first time this year the central-station industry in the West reported operations at the estimated normal during the month of September. The output for the month was 941,618,000 kw-hr., or at the average daily rate of 31,990,000 kw-hr., which is the normal average daily rate of generation for September based on the operations of the industry in this section of the country during the past five years. The industry in this section has been operating at several per cent above the estimated normal since the opening of the year, in spite of the fact that the past five years have witnessed a marvelous development of the industry throughout the West. The total September output of the industry in the country as a whole was 5,020,756,000 kw-hr., or 2.4 per cent above the normal for the month based on the operations of the industry for the past five years. There is every reason to believe that the industry in the country as a whole will continue to operate above the estimated normal for the remainder of the year.

It must be remembered that all these figures are for the electric light and power industry only, and do not include energy generated by purely electric railway companies, Reclamation Service plants, or private industrial generating plants.



CENTRAL STATION CONSTRUCTION OPERATION AND MAINTENANCE

San Joaquin Light & Power Corporation

DAILY REPORT ON TELEPHONE LINES AND APPARATUS

SAN MIGUEL Section or Division Date 192

SUBSTATION	TIME	A. M. REPORT	TIME	P. M. REPORT
Los Alamos				
Betteravia				
Divide				
Santa Maria				
San Luis Obispo				
Atascadero				
Paso Robles				
San Miguel				
Lompoc				

Received By

Fig. 12. Standard report form upon which certain designated stations report daily to the communication superintendent the condition of the telephone lines in their particular division or district. This is in confirmation of immediate information to the load dispatcher.

Power Company Communication Systems — II (a)

Systematic Measures Effect Efficient Use of Lines and Equipment and Reduce Service Interruptions

By H. N. KALB*, Telephone Engineer, San Joaquin Light & Power Corporation, Fresno, Calif.

The best automobile if not properly handled may give much less service than the cheapest automobile efficiently operated. So it is with a telephone system, especially when the wires are located on high-voltage power poles. Even though these lines are equipped with the proper protection at all stations, maximum service is not assured unless the co-operation of all telephone operators and users is secured.

In a power system nearly all of the telephone circuits radiate from the main office or headquarters where will be located the load dispatcher and the telephone operators. In order to obtain the best system-operating service the load dispatcher must have first consideration in all cases. All other operators and all users must understand thoroughly that when the dispatcher asks for the line conversation must be discontinued at once and the line cleared. Also, persons having occasion to use these lines must release the line when someone else comes on the line and states that the line is needed for operation. However, this privilege of operating priority must not be abused, or it will be found that the cries of "Wolf! Wolf!" will not be heeded long. These things are matters of explanation and education, and no small amount of effort should be made to imbue thoroughly all employees with the importance of this feature of system operation.

Another important point of instruction is that of the proper use of the telephone transmitter and receiver. When a person speaks into the transmitter the lips should be within about one-half inch of the mouthpiece and directly in front of it. One should speak in a low, heavy voice and not speak hurriedly. Enunciation is a most important factor in the transmission of the voice, and the person who speaks with deliberation and takes pains to enunciate clearly each syllable will not have to repeat as is often necessary when the speaker is in a hurry and careless. Not only should this fact be explained to substation operators, but it should be demonstrated to them as well. This will be for their own good,

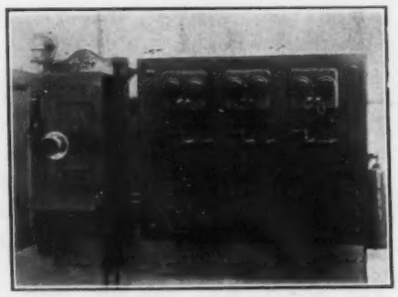


Fig. 13. Typical substation telephone switchboard by the proper use of which it is possible to keep only a minimum of equipment on the line at any one time.

as they may have trouble in making the dispatcher or someone else understand just at a time when they have serious trouble in their own substation.

As noted in a previous article, all fuses are one-half ampere and they may be "blown" at any time without any indication to the substation operator. Therefore, all substation operators on the San Joaquin system are instructed to "listen in" on each telephone line at regular meter-reading

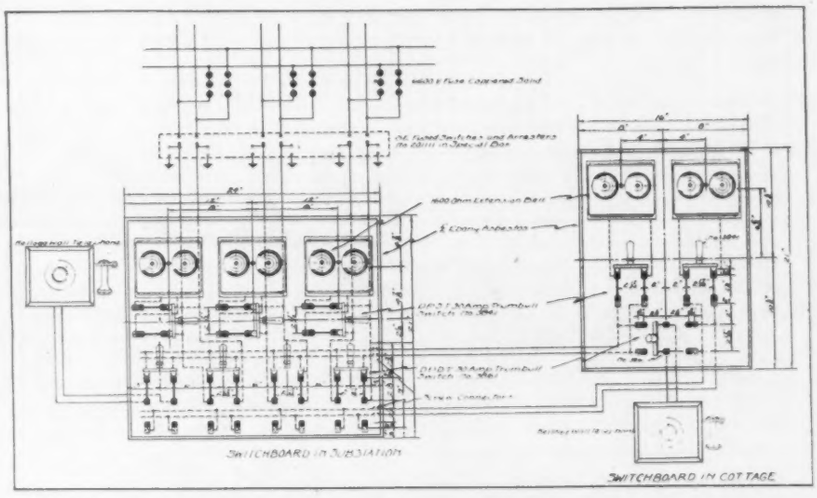


Fig. 14. Wiring diagram of the substation telephone switchboard shown in Fig. 13. This also shows the connections between this board and the smaller board in the operator's cottage.

* All right reserved by the author.

time throughout the day and if the lines sound unusually quiet or unusually noisy to investigate at once. If investigation shows local apparatus to be clear and in operating condition, the operator is instructed to open the line and endeavor to determine which portion of line is in trouble. The dispatcher then is notified of the findings. If the operator cannot determine which way the trouble is from his station, the dispatcher also is so nithfied. Also, if the substation operator does not hear any bells on his telephone for some time (depending on the use made of that particular line) he must "listen in" and, if the line sounds all right, call some station or the dispatcher and ask them to "give him a bell" for test to make sure that he has no trouble.

As a further check all substation operators are required to call some designated substation between 7:30 and 8:00 a.m. and at corresponding hours in the evening to report the condition of their telephone lines and apparatus in general. The operators at these designated substations, after hearing from all other substations in their districts, in turn report to the dispatcher over the telephone and also make written reports on forms as shown in Fig. 12, which are mailed to the superintendent of communication. Any trouble reported to the dispatcher in turn is reported by him to the communication department. All power houses report directly to the dispatcher except in isolated cases. From these written reports or forms it is easy to determine how much time a line has been out of service and whether there is a prevailing case of trouble that appears only at intervals and needs prompt attention.

In order to reduce the transmission and ringing losses as much as possible it is advisable to provide against the substation operator having more than one bell on the line at any one time, and also against his having his own bell on the line when he is talking or ringing. This is cared for by a switchboard as shown in Fig. 13. The electrical circuits of this board are shown in Fig. 14. It may be noted that only two lines are provided from the substation to the operator's cottage. This may have to be changed in rare cases, but it seldom should be necessary. When there is a line in trouble there is someone out to locate and fix the trouble, and the operator should be close to his station building to help with any necessary testing.

Editor's Note: This is the first half of the second of Mr. Kalb's articles. The second half will appear in the next issue.

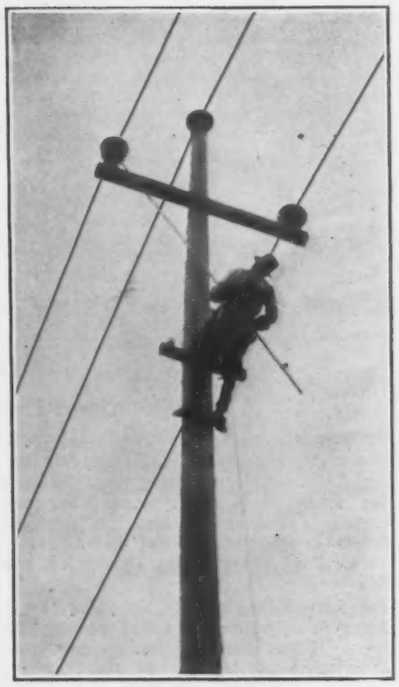
Insulator Testing Aided by Johnson Buzz Stick

Insulator testing on The Washington Water Power Company's transmission line from Post Falls to Cataldo recently was completed successfully with the help of a Johnson "buzz stick." This work was done by a crew of four men who reported satisfaction at the method of doing the job.

The device used is for the purpose of locating defective insulators on transmission lines without taking the line out of service for the tests. It consists merely of a bamboo pole equipped with a small metal antenna and a small spark gap. The latter is adjustable by means of a cord.

The method of using the stick is to first touch it to the line to assure that the line is energized, as shown in the accompanying illustrations. At the same time the spark gap is adjusted to secure a spark. Then the metal antenna is inserted into the various physical divisions of the insulator to be tested, and if a spark results it is indicative of poor insulation.

Preliminary test on the line wire to see that line is energized and to set spark gap on "buzz stick."



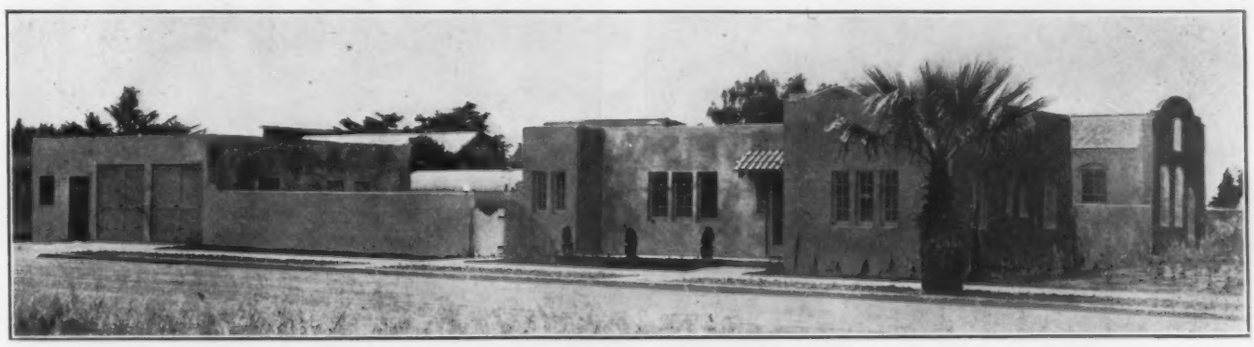
Testing each petticoat of the insulator after the gap has been set by preliminary check on line wire.

This device is expected to be put to extended use in the future.

Much controversy has arisen over the subject of the use of the "buzz-stick" and other similar forms of insulator testing apparatus. Several different devices have been brought out by as many different investigators but as yet patent rights are clouded.

Substation Layout Is Artistic Addition to Community

Setting the example for the many electrical homes to be found in Coronado, Calif., the San Diego Consolidated Gas & Electric Company has erected a group of buildings to house its local substation equipment and operator that are indeed a credit to the community. These are shown in the accompanying illustration. Every electrical convenience is provided for. Appearances further are enhanced through the notable absence of any overhead wires. Power is supplied to the station through two 3-phase, steel-armored, submarine cables from the mainland. All of the feeder circuits also are taken out underground.



A substation layout that would be a credit to any community, the Coronado substation of the San Diego Consolidated Gas & Electric Company. The sub itself appears in the right background, the operator's cottage in the foreground, and the shop and garage at the left

IDEAS FOR THE CONTRACTOR

Electrical Advertising—Its Forms and Design—II

General Sign Design and Several Types of Signs Are Discussed in This Article

By C. A. ATHERTON, National Lamp Works of General Electric Company

No matter what form of display is to be chosen, before a reasonable estimate of the illumination requirements can be made, a study should be conducted of the circulation, the possible observers of the display, and the district. This study should determine the following:

A. Legibility Area—The area of effectiveness, including the greatest distance at which the display must be effective, must be decided upon. Inasmuch as the size and cost of the display depend upon the effectiveness area that is finally determined upon, several estimates may be made and a comparison drawn between the advertising values and the operating costs of the various signs. To do this, a map should be drawn up showing all of the routes of traffic which command a view of the location and a number of circles sketched in, all of them passing through the location of the sign and including various percentages of the possible circulation. A study of the number of passers-by in the various circles of effectiveness and the costs of the respective signs will indicate the sign which gives the greatest advertising value per dollar of cost (initial and operating) and will furnish a firm basis of decision as to the proper size of the display.

B. Smoothness of Illumination—For exposed-lamp signs the shortest distance at which the display should be effective must also be decided upon. This is also often an indeterminate quantity, but again the cut-and-dry method may be used.

C. Necessary Sign Brightness—The district or competing brightness must be classified. The determination of this classification is essential if the greatest advertising value per dollar of expenditure is to be had. It is also a somewhat indefinite quantity. It is arbitrarily assumed that localities may be divided up into districts according to their general brightness and the factor No. 1 is assigned to the brightest. The factor No. 10 is assigned to the darkest district, such as an isolated factory with a small exposed-lamp sign and only a few lighted windows. All other districts lie between these two and with a reasonable agreement may be estimated by anyone familiar with districts 1 and 10. This is illustrated in Table No. 1.

1. Exposed-Lamp Signs

With these general determinations made, the design of the several types of display proceeds as described in the following:

Approximate Rules for Simple Signs

The pattern in a correctly designed exposed-lamp sign consists of an apparently continuous line of light. It is actually made up of a series of spots of light corresponding to the individual light sources. The exact size of these spots may be accurately calculated (the method for doing this is described in Part II) or it may be assumed to be approximately proportional to the distance at which the sign is seen. From such an approximation there follows a set of simple equations which are sufficiently accurate for the design of most signs.

The first of these approximate equations, by which the letter size is determined, applies only to rectilinear letters, the proportions of which are about 3 in width to 5 in height. Frequently the dimensions of the sign are limited by the space available. The size of the smallest letter, however, should never be decided upon without first considering its relation to the greatest distance at which the sign should be effective.

When the following relationship exists, good advertising value for the sign under almost any possible conditions is practically assured so far as size of letters is concerned.

Letter Height for Good Advertising Value

$$H \text{ (in feet)} = \frac{D \text{ (in feet)}}{250}$$

in which H is the height of the letter measured from the topmost lamp to the bottommost lamp in a complete vertical stroke, and D is the greatest viewing distance.

Table No. 1—District Brightness Factor

Factor	Description of District
1	Extremely bright square.
2	Very bright centers.
3	Bright square in large cities.
4	White ways in large cities. Public square in smaller cities.
5	Business districts (not white ways) in large cities — White ways in smaller cities.
6	Business districts in smaller cities. Outlying districts in large cities.
7	Outlying districts in smaller cities. Centers of small towns.
8	Darker outlying districts with an occasional store, etc.
9	Lighted highway but no stores.
10	A small isolated display—no street lights or store windows.

Greatest viewing distance (D) is the diameter of the circle of effectiveness

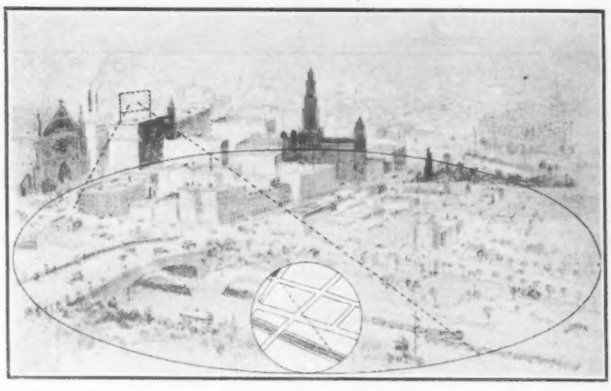


Fig. 8—The economical circle of effectiveness for the display first must be decided upon.

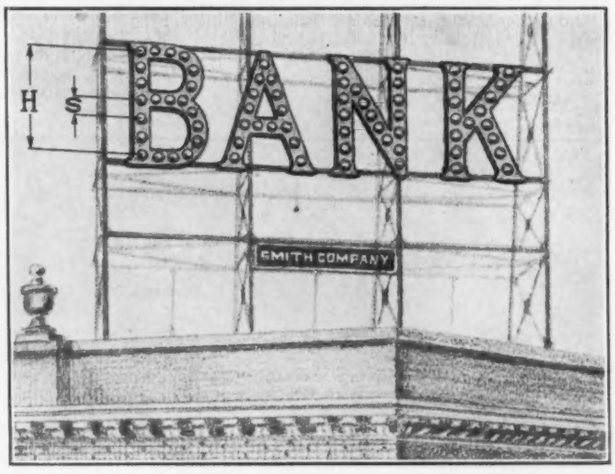


Fig. 9—Letter height (H) is a function of the greatest viewing distance. Lamp spacing (S) is a function of the shortest viewing distance.

or the greatest distance at which the details of the sign must be readily apparent.

This equation holds true for letters with a single line of lamps only.

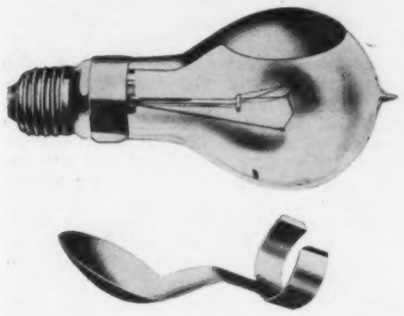


Fig. 10—Gas-filled lamps, burned horizontally in exposed-lamp signs, should be protected from rain, which so frequently causes breakage by sudden chilling. This metal cap prevents such breakage.

Frequently for one reason or another it is desirable to install a smaller sign in a given location. It will have a lower advertising value at a given distance but will still be legible to the majority of people until the following relationship is approached:

Letter Equation for Maximum Reading Distance

$$H \text{ (in feet)} = \frac{D \text{ (in feet)}}{500}$$

Signs should be designed with letters somewhere between these two values. Signs with letters smaller than is given by the second equation should never be used unless it is agreed that the legibility of the individual letters can be sacrificed.

In a few cases advertising value for a sign may be fairly high when the letters are made smaller than those given by the second equation. This is true when the shape of the sign is such that it will be recognized as a familiar trade mark at distances where the lettering is no longer legible or where the wording is so familiar to people that its general conformation is recognized without the need of deciphering all of the individual letters. Some signs have an effective advertising value at distances greater than those for which they are designed because of a persistent advertising program which has imprinted characteristic outlines or commanding location in the subconsciousness of the public.

The second problem of the sign engineer is the determination of the proper **lamp spacing** and the selection of the proper **lamp.**

Inasmuch as the lamp spacing depends upon the size of the spots of light and these depend upon the viewing distance, the lamp spacing is determined by the shortest viewing distance. The following approximate relationship should be used if it is required that the elements of the sign shall appear smooth and not spotted.

Lamp Spacing for Smooth Appearance

$$S \text{ (in feet)} = \frac{D' \text{ (in feet)}}{1000}$$

in which S is the distance between adjacent lamps, and D′ is the shortest viewing distance.

A wider spacing is sometimes used to reduce the cost of the signs. This results in greater spottiness. The proper lamp spacing for a sign, the shortest viewing distance of which is less than 250 ft., would, according to the above equation, be less than 3 in. The lamps cannot be located on much less than 3-in. centers because of the size of the lamps.

The **number of lamps** in the sign now may be approximated as follows:

Number of Lamps—

Exposed-Lamp Signs

$$N = \frac{H}{S} \times \text{Number of letters} \times 2\tfrac{1}{2},$$

for the ratio of average letter outline to vertical stroke is 2½.

The **proper lamp size** is determined primarily by the district brightness and secondarily by the maximum distance to which the sign must carry. The following equation which is based upon average atmospheric conditions in the various districts corresponding to the brightness factors involved will give the most suitable lamp size for all exposed-lamp displays. Select the standard lamp which comes nearest to the calculated figure from the following equation:

Lamp Size for Exposed-Lamp Signs

$$\text{Lamp Watts}^* = \frac{10 \times \sqrt[3]{D'' \text{ (in feet)}}}{D\,B\,F}$$

in which D″ is the maximum distance and D B F is the district brightness factor.

(Example: The lamp watts for a sign located in a large city square with the district brightness factor, say 3, which must be effective up to a mile is equal to:

$$\frac{10 \sqrt[3]{5000}}{3} = \frac{10 \times 17.1}{3} = 57.$$

A 50-watt lamp is indicated.)

*This applies to clear lamps only. When blue glass bulbs (i.e., daylight) lamps are to be used, the next larger size will often be found to be desirable. When colors are used, either from a spray coating on the lamp or a color hood over it, a larger wattage is necessary to give the same brightness effect. The wattages in the table should be multiplied as follows when equal brightness is desired:

For yellow light	multiply wattage by 1.5
For orange light	multiply wattage by 2
For amber light	multiply wattage by 2
For green light	multiply wattage by 3
For red light	multiply wattage by 4
For blue light	multiply wattage by 15

Lamps larger than 100 watts should not be used; however the correct wattage per foot of line length as determined in this way should be maintained. This will often require two or more lamps in the place of one where color is to be employed. It should be noted that where color is used in exposed-lamp signs a lower brightness often suffices or is indeed to be preferred. Hence these wattage recommendations should not be taken as a general rule for all applications.

Table No. 2—Cubic Root Values for Use in Lamp-Size Equation

Number	50	75	100	150	200	250	300
Cube Root	3.7	4.2	4.6	5.3	5.8	6.3	6.7
Number	400	500	600	700	800	900	1000
Cube Root	7.4	7.9	8.4	8.9	9.3	9.7	10
Number	1200	1500	2000	2500	3000	4000	5000 (1 mi.)
Cube Root	10.6	11.4	12.6	13.6	14.4	15.9	17.1
Number	7000	10000 (2 mi.)		15000		20000 (4 mi.)	
Cube Root	19.1	21.6		24.7		27.2	

When the sockets are located less than 25 ft. from the ground, the display will have a better appearance if diffusing-bulb lamps are used.

Fig. 11—Enclosed-lamp signs are usually seen at comparatively short distances. Greater care should therefore be exercised to make their cases and mountings more artistic.

Gas-filled lamps when burned in a horizontal position and when exposed to the weather may be cracked by rain, especially in sizes above 50 watts. They should be protected by a small tight-fitting metal cap on the bulb. This will greatly reduce the breakage.

2. Enclosed-Lamp Signs.

The effectiveness of an enclosed-lamp sign depends upon two characteristics. First, the sign may be given a pleasing daytime as well as night time appearance and second, the diffusing glass, when kept clean and properly illuminated, given the effect of smoothness, trimness, and dignity.

Fig. 12—The edges of most enclosed-lamp signs are ugly black troughs of wasted space. They should be decorated or used to carry additional messages.

In order to capitalize the first char-

acteristic, that of good daytime appearance, these signs shrould be very carefully designed; greater effort should be used to make the metal case more artistic; it should be given a finer finish; and it should be made to harmonize with the building on which it is to be mounted.

For these signs in which extreme brightness and many motion effects are not possible, beauty and individuality are essential to effectiveness.

While the second characteristic, that of whiteness and smoothness of the illumination, is present in new signs, everyone has noted displays of this type where the letters are dull and lifeless and the illumination spotted as a result of failure to clean the letters and the inside of the box and to replace lamps. In many cases the construction has been such that it has been possible to replace lamps only with great difficulty and almost impossible for the maintenance man to clean the inside of the glass letters. In making or purchasing a sign of this type the construction should include hinges on at least one face. One application of this feature is illustrated ing Fig. 16.

The chief problems for the preliminary estimate are first, to determine the size of the letters for a given range of legibility; second, to determine the proper spacing of the lamps for smooth illumination; and third, to determine the proper wattage of the lamps to furnish correct brightness. The procedure given below applies only for signs with standard block letters.

The size of the letters depends upon the greatest distance at which they must be effective. This may be approximated as follows:

Letter Size for Enclosed-Lamp Signs

$$H \text{ (in feet)} = \frac{D \text{ (in feet)}}{300}$$

in which H is the height of the letter measured on the center lines of the top and bottom strokes of the letter, and D is the greatest viewing distance.

The lamps should be spaced so that the filament centers of no two adjacent lamps are more than 6 in. apart. (See Figs. 14-A and B. For illumination of large surfaces this requires lamps at the corners of equilateral triangles, 6 in. on a side, covering the pattern. For the illumination of a sign, in which the units (words, letters, or pictures) are made up of rectangles, the **number of lamps** per rectangle, equally spaced to cover it, equals the nearest even number larger than N in the following equation:

$$N = \frac{WH}{40}$$

in which W is the width and H is the height of the rectangle in inches.

(To be continued.)

Illumination System Installed Around Lake Merritt

Lighting Standard, Underground Cable and Method of Control of All Lights Are Features of This Installation

By ROMAINE W. MYERS, Consulting Electrical Engineer

The decorative illumination system installed around Lake Merritt in Oakland, Calif., includes 126 lighting standards with special Venetian lanterns spaced about 125 ft. apart along the lake shore in staggered formation. The lighting standards have exposed surfaces of copper and bronze fittings which will be allowed to take a natural weathered finish. They were manufactured in Oakland by the United Iron Works. Since the installation was made possible by popular subscription, each standard bears a bronze plate with the name of a subscriber. The lanterns are General Electric Company, form 19, large pendant type with a symmetric type dome refractor and holder, their exposed surfaces are of bronze alloy, acid-dipped. The dome refractors direct a large portion of the light upon the water so that the benefit of the reflection of the lake surface is secured. The lanterns have amber cathedral glass panels. Four-thousand-lumen 14.8-volt 15-amp. Mazda lamps are used in each one.

The system service is three phase, four wire, 4,000 volts. The lighting standards are supplied with two circuits from constant-current transformers, with a maximum voltage of 5,000. General Electric subway-type current transformers are placed at each standard, reducing the voltage at the lamp to 14.8.

Steel-taped armored cables were installed between each of the lighting standards and from them to the control station. Over 20,000 ft. of 5,000-volt Parkway cable were used in making the installation, the majority of which was four and six conductor No. 8 solid with Okonite insulation. This cable was ordered, manufactured, inspected, tested by the Electrical Testing Laboratories for the consulting electrical engineer, shipped and delivered in fifty-five days to destination. Time was an important consideration in this job as it had to be entirely completed within 93 days in order to avoid a penalty of $50 per day. The cable was installed in a trench 18 in. deep; this trench had to avoid trees and large roots.

The lighting standards are mounted on concrete bases containing an absolutely watertight chamber for the transformers.

Festival Lighting

Ample provisions have been made for special lighting arrangements for pageants and festivals. Each lighting standard is equipped with hooks for attaching multiple strings of lamps, and alternate standards have a Hubbell No. 5614 receptacle for connecting these lamps with the power supply.

At alternate lighting standards a special 2-kva. Kuhlman Electric Company subway-type transformer is installed to supply power for the festival lights. These transformers operate on a 6.6-amp., 5,000-volt, 60-cycle series circuit; secondary voltages vary from 105 volts at full load to 127½ volts at no load.

It is an innovation to produce series transformers for operation on a multiple secondary of the capacity used. This provides a very flexible system eliminating the use of a great number of multiple transformers with their cut-outs and sub-feeders, thus controlling through two constant-current transformers all the multiple festival lights. It is proposed to illuminate a Christmas tree to be installed between each standard during the Christmas holidays, each tree to have fifty 10-watt 110-volt lamps. These lamps operate on a less wattage than the transformer capacity; the rise in voltage can be compensated for by the setting of the dimmer control apparatus.

Between the poles are concrete sockets for 21-ft. flagpoles which serve as central supports for the festoons. Each festoon contains 24 moulded weatherproof pendant sockets which are supplied with 40-watt, 110-volt Mazda lamps. These lamps were inserted in special cambric lanterns when the installation was dedicated on the opening night of the Dons of Peralta festival this fall.

Floodlights

Floodlights are installed in a number of places around the lake in order to illuminate some of the groups of trees and shrubs. Thirty-two Wheeler Reflector Company floodlights are used for this purpose. They are installed in a watertight concrete container as shown in Fig. 2. Two-kva. Kuhlman Electric Company subway-type transformers are installed at eight of the lighting standard bases to supply power for the floodlights. The transformers operate on a 6.6-amp. 5,000-volt series circuit and supply a secondary full-load voltage of 105 and 127½ volts at no load. Six hundred-volt two-conductor No. 8 steel armored cables are run from these transformers to the floodlights; this cable was laid in an 18-in. trench. Each floodlight is equipped with a 500-volt Mazda lamp.

Control Station

All of the lighting standards, festival lights, and floodlights are controlled from a central control station. The main switchboard, circuit breakers and current coils are of General Electric Company manufacture. One 35-kv. General Electric type R. V. 2,300-volt primary 60-cycle, 6.6-amp. and one 20-kw. General Electric type R. V. 2,300-volt primary constant current transformers are installed. On each of these there is installed a 1/8-hp. single-phase, 1,200-r.p.m. 110-volt 60-cycle motor and chain gearing connected to a magnetic clutch. A 7-in. Cutler-Hammer magnetic clutch which connects to an enclosed reduction gearing (approx. 4,800 to 1) is connected to the sector mechanism of these transformers. The movement of the magnetic clutch is so arranged that the normal current can be reduced in the transformer to a value that will bring the lamp filament to a dull red. The gears are such that the time limit of operation from normal current on full candlepower of lamps to dull red of the filament is one minute. When the solenoid of the constant-current transformer reaches either the low or high operating point the motor and magnetic clutch mechanism automatically disengages. This motor operates with a start, stop, and reverse push button controlling the reversing contactor and its mechanism. A 250-watt, 110-volt

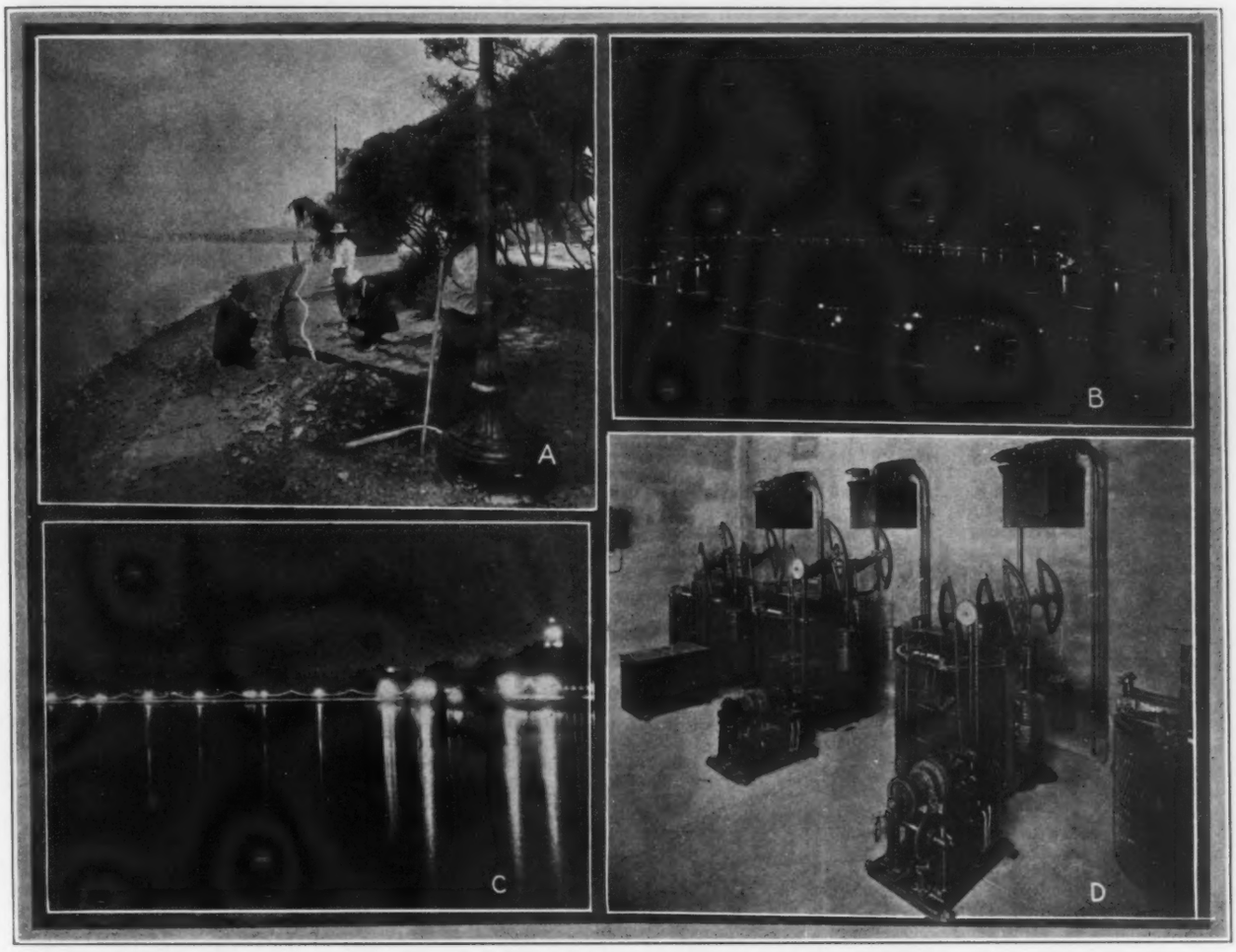


Fig. 1. Several views of the illumination system installed around Lake Merritt. A—Steel-taped armored cables being installed between standards in a trench 18 in. deep; this trench had to avoid trees and large roots. B—Night view showing practically the entire lake; the festoons of festival lights may be seen between the standards. C—Another night view showing the great amount of reflection secured from the lake surface. D—General view of the control room showing the magnetic clutch mechanism and other control equipment.

d.c., 110-volt a.c., single-phase, 60-cycle motor generator provides the direct current for operation of the magnetic clutch.

The writer designed the installation which was made by the Central Electric Company under the direct supervision of J. M. and D. M. Carlson.

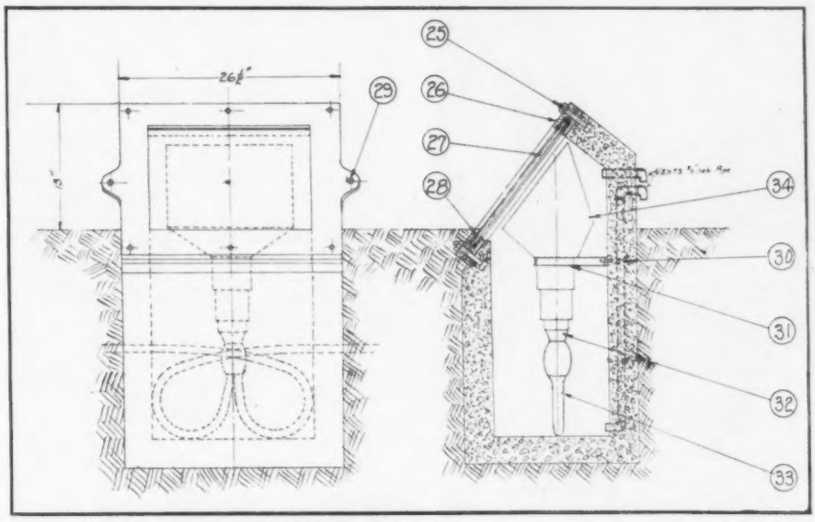


Fig. 2. Detail of one of the floodlights used to illuminate some of the groups of trees and shrubs. This is installed in a watertight concrete container. Legend: 25, bolts; 26, frame; 27, glass; 28, gasket; 29, padlock; 30, bolt; 31, clamp; 32, ferrule; 33, cable; 34, floodlight.

Fig. 3. One of the main lighting standards; these have exposed surfaces of copper and bronze fittings.

BETTER MERCHANDISING

Christmas Trees in Sidewalk Flagpole Sockets

Loveland, Colo., Uses City Street-Lighting Circuits to Light Trees in Business District of Town

The Christmas season, with its accompanying propensity towards varicolored and brilliant lighting effects in homes, night shopping in the stores and evening functions at churches, clubs and residences, is a pretty benevolent aid to the "juice" salesman. Yet, there are ways of helping a good thing along, as was demonstrated aptly last year at Loveland, Colo., by V. M. Johnson, commercial manager of the local Public Service Company of Colorado organization. Mr. Johnson turned a clever Yuletide idea into profitable business for his department and incidentally promoted an effective bit of holiday advertising in his home city.

In casting about for means by which he might exercise his business-getting talents, Mr. Johnson conceived the plan of using some permanent flag standards placed by the American Legion Post in front of practically every store on the principal downtown streets of the city. First he ordered a supply of uniformly sized evergreen trees from a mountain resident near Loveland. Then, armed with a contract form, he sallied forth and sold his idea to seventy-two merchants of the city.

As a result, each store participating in the plan was given a Christmas tree adorned with brightly colored electric globes. These were set in the flag standards and the decorative scheme properly carried out by attaching the temporary lamp circuit to the city's boulevard lighting system.

Through Mr. Johnson's originality and initiative, Loveland's business district presented an exceedingly attractive holiday picture at night, and the new business department of the Public Service Company showed a substantial increase in sales for the month of December. In addition, merchants profited because of the effective method of advertising and novel manner of promoting the Christmas spirit.

Utilizing flagpole sockets at the curbs for Christmas trees, lighting was provided from city street-light circuits in Lovleland, Colo.

Will Start Finance Company to Aid Refrigerator Sales

Aiming to take full advantage of the great interest which has been aroused in the possibilities of electrical refrigeration for domestic use, the Southern California Edison Company has completed arrangements with several manufacturers of refrigerators that will permit of close co-operation between the Edison sales organization and the branch sales organizations of those companies.

Each of the thirty-one district offices of the Edison company will be a sales center for the spreading of the gospel of electrical refrigeration. It is planned to have on display in all offices one of the samples of the different makes selected, and a specialty salesman is to work out of each of these district offices.

An extensive advertising and sales campaign is to be launched which will serve to tie in in the public mind the idea of electrical refrigeration for the home, the standard makes available, and the Southern California Edison Company. Plans called for the opening gun to be fired in the newspaper campaign Dec. 1, 1925, to be followed by a concentrated effort after the holidays.

Falling in line with general commercial practice, the Edison company expects to sell the refrigerators, when necessary, on a time-payment plan. In order to make effective an easy-payment plan, the Edison company probably will arrange for the incorporation of a finance company to buy this paper and carry it at a fair interest. Such an acceptance company would operate independently, although a number of Edison officers and managers would be stockholders.

Independent contractors are to be encouraged to participate by being given an opportunity to take advantage of the services of the finance company. This would be of considerable advantage to small dealers and contractors who would be assisted thereby in swinging a considerable volume of business without tying up their capital.

Apartment House in Portland Well Equipped Electrically

One of the modern apartment houses in Portland making extensive use of electric service is the Castle Rose Apartments, built by L. Siegle early in 1925 on the Sandy Boulevard at East Irving Street. Each of the thirty-four two and three-room apartments contains a full-automatic, Westinghouse, type E-20, bungalow electric range, and in addition one of these ranges is installed in the kitchen of the ball room, which is kept open every evening for the use of tenants and their friends. A central laundry, free to all tenants, is equipped with two electric washing machines and electric irons and ironers. The hot water heating plant burns oil and utilizes a motor-driven feed and also a motor-driven circulating pump. Unique radio service is supplied to tenants through a superheterodyne receiver operated by the management every evening until 10 p.m. An outlet in each apartment and in the ballroom permits the attachment of a loud speaker at the desire of the tenant.

Interesting from the standpoint of the load diversity it indicates is the fact that the entire electric service for the building, including both power and light, is taken care of on a 30-kw. transformer. For the benefit of regulation this transformer is housed in a vault in the basement of the building, and in order that the beauty of the setting of the building might be as little marred as possible the 2,500-volt primary service is run underground to this vault from a pole on the street adjacent to the property.

Service is supplied by the Portland Electric Power Company, which also sold the kitchen equipment. The M. J. Walsh Electric Company did the wiring and installed the radio equipment. Carl Linde was the architect.

Washing Machine Company Offers Twenty-Year Guarantee

An innovation in the merchandising of electric washing machines has been introduced by the Johnson Washer Company of Oakland, Calif., in the issuance of a twenty-year guarantee with each Johnson Impeller Washer sold. This guarantee reads:

1. We hereby guarantee the above Johnson Washer to wash all fabrics that can be cleaned with soap and water.

2. To be made of the best of materials and workmanship and agree to replace, free of charge, within 20 years, any part proving defective upon return of the part, prepaid, to factory for our inspection.

3. Furthermore, if the copper tub on this washer should burn out in service while containing water, or leak from corrosion or deterioration of the metal, within a period of twenty (20) years from date of sale, we will replace it.

(Motors, wringer rolls and switches carry guarantee of their respective manufacturers.)

In discussing this step in the company's merchandising campaign, G. B. Schuyler, sales manager, said:

The policy has behind it the experience and observation of twenty-three years. During this time, Johnson washers have been subjected to all kinds of working conditions, yet over this period the cost of replacements per machine has been practically negligible When replacement costs remain at a minimum for twenty-three years, there can be no doubt as to the conclusion nor to the logic of the policy which rests upon that conclusion. Moreover, modern advertising has made it possible for the manufacturer to deliver his sales message directly to the public, which has confidence in a product, provided its manufacturer has confidence in it. Hence, the Johnson washer twenty-year guarantee is an expression of such confidence, a bond of good faith between the manufacturer and the buying public.

Mr. Schuyler expressed the belief that the new policy would result in greater public confidence and increased sales.

Many Dealers Create Business By Means of Window Clock

Everybody who walks down the street is interested in the time of day. Nearly everyone has a watch but not all watches are accurate and it is only human nature to compare one's timepiece with one that is known to be accurate. A standard clock, that is always on time, soon becomes a matter of popular interest and forms a strong medium for drawing attention. Many electrical dealers have placed such a clock in their show windows and have found that it was of considerable help in increasing sales. Passersby soon became accustomed to stopping at the window to get the right time and their attention was drawn to the merchandise on display. Special displays and window cards to tie in have been used to promote lamp business and to develop sales on other lines. For example: one dealer, at the approach of dusk, has used a card reading "Time to light up" and has had this card surrounded by a small lamp display. Others have used different cards for different days of the week, as on Monday, "Time to put in some convenience outlets"; on Tuesday, "A good time to have your house properly wired" and so on throughout the week, featuring specials for each day.

Real Outdoor Demonstration Room Sells Appliances

Southern Electrical Company Takes Out Window to Provide Sidewalk Demonstration Space that Stops Crowds

Harking back to first principles in merchandising, when the street bazaars and markets were the only stores in existence and the merchant spread his wares on the ground on some crowded highway, an electrical establishment in San Diego is finding that old principles still work, that "there's nothing new under the sun," indeed. This firm has torn out a window from its storefront to provide itself with a demonstration space right at the sidewalk of the city's busiest street.

Many electrical establishments have utilized the same principle in degree, it is true. There have been instances unnumbered of washing machines or vacuum cleaners being demonstrated in the entrance-way of electrical stores. But it remained for the Southern Electrical Company of San Diego, the city's oldest electrical contractor-dealer, at its Seventh and Broadway store, to go the one step farther which brought the merchandising of such appliances back to first principles.

The Southern Electrical Company, in common with other electrical stores, has used demonstrations in its entrance-way, and for bigger appliances, such as washing machines and ironers, it has devoted an entire window to attracing the crowds by window action. Yet it found both these methods limited in their effectiveness in that the passerby, her curiosity aroused, could not ask questions of the demonstrator without going into the store, and often did not wish to compromise herself to that extent.

It was seen that the windows must be removed to make such demonstrations most effective, especially since the entrance-way of this branch store was not as wide as could be desired. So the window was removed and placed to the rear of the demonstration area, where it could still be utilized during evening hours to show off electrical appliances to advantage.

The idea has proved to be entirely practical. A washing machine and ironer or vacuum cleaner can be demonstrated from this show room on the street itself at the same time. Passing crowds are stopped by the actual demonstration being carried on without intervening window. They can ask the demonstrator questions, and vice versa, the demonstrator can get at them directly with her sales appeal. An offer of a demonstration at home brings many prospects upon which the store sends out a member of its trained staff of salesmen to follow up such leads.

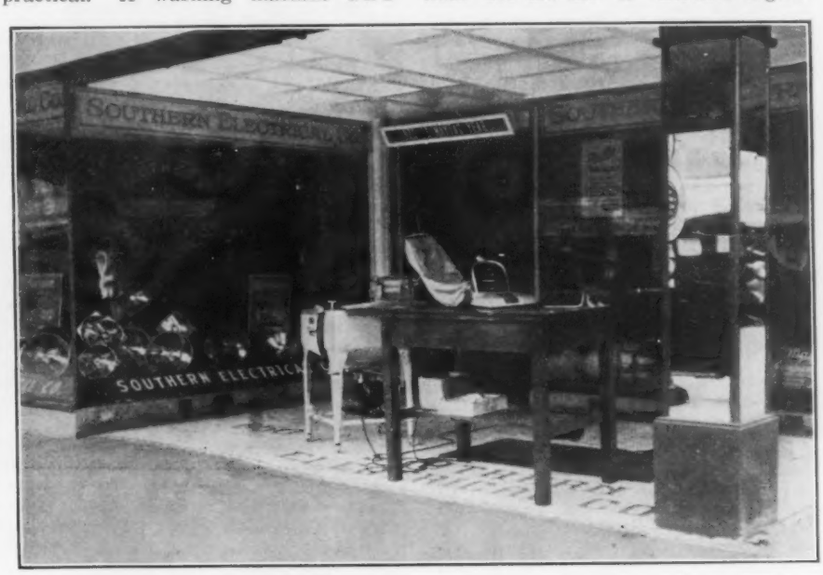
Other electrical merchandise is sold, too, as a consequence of the direct contact of the demonstrator with the passing crowds. The demonstration space is used effectively also during special sales of appliances.

Lamp Sales Plan Attractively Presented by Folder

Well organized and presented is the lamp sales material contained in the folder, "More Power to You," with which the Edison Lamp Works is giving its assistance to central stations in the increasing of lamp business.

The book starts out with a cartoon presentation of popular fallacies concerning the cost of lighting service, and goes on to state that the public will buy more current, more lamps, and appliances, be less apt to complain, require less correspondence from the complaint department, become shareholders and reflect to the favor of the company in political issues, if it is sold on the idea that electric service is worth every cent asked for it.

Pamphlets to be sent out with monthly bills, cards for distribution by meter readers, window displays, newspaper advertisements, forms of correspondence, stickers for envelopes, are given as examples of methods whereby this sort of educational campaign may be carried on. It is urged that the home lighting essay contest be followed up, and that monthly bills be revised to read "for Electric Service," rather than "for Kw-hr." or "Electric Light."



Out on the sidewalk to stop the passing crowds the outside demonstration space of the Southern Electrical Company of San Diego proves an effective sales builder.

NEWS OF THE INDUSTRY

Tri-State Agreement on Colorado Development Now Up to Arizona for Ratification

Aiming to have the states of the Southwest present a solid front at Washington when the question of the development of the Colorado River is brought up, representatives of the states of California and Nevada laid before Governor Hunt's Arizona Colorado River Committee a draft of a tri-state agreement in Phoenix, Ariz., Dec. 1. This tri-state agreement is to serve as a supplement to the Colorado River compact formed at Santa Fe, N. M., in 1922, that six of the seven Colorado River states approved. Arizona alone refusing to sign. Representatives of California and Nevada had drawn up and agreed upon the terms of the tri-state agreement at a meeting held in Los Angeles Nov. 30.

Concessions and guarantees are made intended to assure to Arizona an ample supply of the water and power derived from the river to enable that state to develop its own resources to full capacity. A provision whereby Arizona is to receive what it is estimated will amount to $500,000 a year from power developments at Boulder Canyon was expected to have considerable influence in the shaping of Arizona's attitude toward the agreement.

The plan has been taken under consideration by Governor Hunt and his representatives, who have intimated that they will be prepared to submit a counter proposition at the next meeting. It is intended that this proposal will set forth clearly the conditions under which Arizona would feel justified in entering into any agreement concerning the Colorado River. Approximately ten days will be required to formulate this proposal, according to C. W. Van Dyke, chairman of the Arizona committee, which tentatively sets the date for the next conference about Dec. 15.

Briefly summarized the tri-state agreement as proposed by California and Nevada provides:

1. All water contributed by Arizona rivers to be used solely by Arizona—approximately 1,000,000 acre-ft.

2. Water which now is being used by the states is allocated definitely to the present users. Rights to this water are not in any way affected by the present proposal.

3. Allocated to California—1,095,000 acre-ft. This is the equivalent of the 1,500 sec. ft. which has been filed upon by California municipalities for domestic water.

4. Allocated to Nevada — 300,000 acre-ft. in addition to the entire output of the Virgin River.

5. All remaining water to be divided equally between California and Arizona, with a provision that any of this water which is not in beneficial use by 1975 shall be available for definite allocation to either California or Arizona. This is to protect Arizona in case California should develop a "beneficial use" for the water more rapidly than Arizona.

6. Arizona and Nevada are to be paid one dollar per horsepower of electric energy developed at Boulder Canyon. It is estimated that this will amount to $1,000,000 per year or $500 000 to each state.

The California legislative committee members present at the conference with Governor Hunt's committee were Senator Ralph Swing of San Bernardino County; Assemblymen Walter Little of Los Angeles, and A. C. Finney of Imperial County. Governor Scrugham of Nevada was represented by Mr. Squires and Mr. Clark, both of Las Vegas, and the entire membership of Governor Hunt's committee was present, namely, W. Van Dyke, A. G. McGregor, F. A. Reid, Thomas Maddocks and H. S. McCluskey, secretary to the governor.

Fear Park Boundary Extension Will Stop Development

Future hydroelectric power development in northern Colorado would be retarded greatly if not nullified completely by revision of the boundary lines of Rocky Mountain National Park as now proposed, according to those familiar with the situation.

Several additions of lands now held by the Forest Service are proposed by President Coolidge's co-ordination committee on outdoor recreation, but the one most in point is a strip to the south of the present park boundary. It extends along the crest of the Continental divide, lapping over from three to four miles on either side and containing approximately 60,000 acres.

On the western side of the range this territory includes the headwaters of the Colorado River. The proposed Colorado River Compact allocated something over 1,500,000 acre-ft. of the waters of that river to Colorado. All of the available water cannot be put to use on the western slope where it originates, however, and it will be available in part for conveyance to the east side by tunnels. If under the control of the National Park Service, however, it would be difficult to secure.

When investigations of water resources were being made by the Doherty Company's engineers prior to construction of the Public Service Company of Colorado's new Valmont steam plant, only two adequate sites in the state were found. One of these was in the San Luis Valley and was eliminated from consideration through its great distance from the center of power use. The other feasible project discovered involved tunneling the Continental Divide and bringing water from the Colorado River through to the eastern side.

The logical outlet for such a tunnel would have been in Moraine park, a part of Rocky Mountain National Park. Inquiry developed the fact that it would take an act of Congress or some equally involved procedure to make this site available to use.

The only other feasible plan was found to be that of tunneling the divide from Monarch Lake on the west to a point on the headwaters of the St. Vrain River on the east. Here it was found that by angling the tunnel slightly its eastern portal could be made to escape the park boundaries.

Such a tunnel would be approximately 17 miles long and would have available for it water from a drainage area of 325 sq. mi. As all the power which it would generate could not be used at this time, the project was cast aside in favor of steam.

However, in the opinion of the investigating engineers, the time will come before many years when such utilization of western slope waters will be entirely practicable. They accordingly are alarmed at any movement to extend the park boundaries to include any of this water. In view of their investigation and the experience of others, coupled with the traditional policies of the National Park Service as regards power and reservoir filings, they feel that it would be contrary to the power interests of the state to make the rearrangement.

The lands which would be included in the park are at present a part of the Colorado National Forest and are administered by the Forest Service.

Los Angeles Electric Railway Unification Recommended

Recommending the unified operation of the lines of the Los Angeles Railway and the Pacific Electric Railway Company, a report of a joint committee of engineers has been filed with the board of public utilities and transportation of Los Angeles. The joint board of engineers was made up of J. O. Marsh, chief engineer of the city board of public utilities and transportation; L. S. Ready, chief engineer of the California Railroad Commission; and Richard Sachse, formerly chief engineer of the railroad commission but now representing the two railway companies.

The report upon which this joint board of engineers has been working for two years suggested two methods whereby unification might be accomplished: first, by city ownership of the combined properties, or second, the absorbing of the Los Angeles Railway by the Pacific Electric company.

Municipal Ownership Proves Stormy Subject at Western Division Chamber of Commerce

With proponents of municipal ownership and operation of power systems arrayed alternately between advocates of private operation on the program of one of the sessions of the third midyear meeting of the Western Division of the Chamber of Commerce of the United States, that session devoted to the general topic of "The Hydroelectric Power Situation in the West" developed into a veritable debate. The session was held at the Olympic Hotel, Seattle, Dec. 7. It was attended by about 400 delegates and guests from the eleven Western states and presided over by Paul Shoup, vice-president of the Chamber for the Western Division, and vice-president of the Southern Pacific Company, San Francisco.

By way of introducing the general topic, an animated motion picture was shown depicting the dominating position of the Pacific Coast in its hydroelectric supremacy as compared with the East, and presenting the story of the remarkable development of the electrical industry in the eleven Western states during the past forty-five years. Commencing with 15 hp. in use in 1880, a graphic story of growth in generating stations and transmission lines by five-year periods was shown to equal 4,470,000 hp. in 1925. Among the interesting analyses of this figure was that portraying the fact that only 435,000 hp. of this total had been developed under municipal ownership, the balance having been put in service through the enterprise of private initiative. The picture was prepared from data collected from all utility companies of the district by the Southern California Edison Company and produced under the direction of Herbert A. Barre, its executive engineer.

Following the picture, R. H. Ballard, executive vice-president and general manager, Southern California Edison Company, discussed the power situation in southern California. Supplementing the data given in the picture he said, "It was found that in those communities where the electric system was in the hands of business men, rather than town and city officials, the growth of the business was much more rapid."

Further, "We look back over the entire history of government ownership in vain," he said, "for any instance where any municipality or any state ever made one single major advance in the art of production, distribution and sale of electricity." Taking up the claim of government-ownership advocates, that governments can secure capital cheaper than the private companies, he pointed out that the differential between cost of capital to a municipality and to a private corporation represented taxes, which is no saving at all. Mr. Ballard stated at the beginning that his address had been prepared by John B. Miller, president of his company, for whom he was substituting because of Mr. Miller's unexpected inability to attend.

The Northwest was represented by O. B. Coldwell, vice-president and general manager, Portland Electric Power Company, Portland, in the discussion of hydroelectric possibilities on the Pacific Coast. After outlining the potential water horsepower in Oregon, Washington and Idaho, and the percentage that had been developed, he said, "Wherever there is a plentiful supply of cheap fuel from reliable sources to be had, as in the case of many parts of the United States, even in some sections here in the Northwest, there will be a careful analysis of cost made before water power is developed, and when it can be shown that the cost of electric energy is cheaper if developed by steam power, it is certain the steam method will be used." He attacked the "common practice of advocates of government ownership of water-power developments to present estimates of cost of producing power at the power plant as the price at which power may be obtained at the customer's premises," by stating that for every dollar invested in the generation end of the business there is at least another dollar and a half invested in transmission, distribution and utilization facilities.

Power development in the Northwest under municipal ownership was discussed by J. D. Ross, superintendent, City Lighting Department, Seattle, who said, "Had there not been so much political enterprise among operators of privately owned utilities in the past few years, there would not have been so much enterprise in political operation of electric utilities." Stating that the use of electrical energy doubles every four and one-half years in the state of Washington, he urged an immediate and continuous development of the water powers of the state by both private and governmental agencies to keep up with this growth. Pointing to the Skagit development of Seattle and the Cushman project of Tacoma as signal achievements under munipical control, he said, "If we municipal fellows, inefficient as we are said to be, can make successes of these enterprises, then the private operators must make wonderful profits."

Dropping a well-aimed bombshell into the meeting at this point, Norwood W. Brockett, director of public relations, Puget Sound Power & Light Company, Seattle, next called upon to discuss private operation in the Northwest, took exception to Mr. Ross' shots that had been aimed at private operation in general and his company in particular. Denying the charge that private companies had been negligent in developing the water resources of the district, he said, "No industry has ever been turned away from Washington for lack of available power and none ever will be." He showed how a private company surveyed the market possibilities before entering into an expensive development program, proving that over-development could not possibly mean cheap power on account of the fixed charges on idle investment that it entailed.

Discussing the attempt made in the West to induce new industries to locate there, and calling attention to the investment of $100,000,000 in his company, he urged that one way not to attract industry was by trying "to crucify the investment already here." Accepting Mr. Ross' implied challenge to deal in specific things rather than "glittering generalities", he called attention to some of the mistakes, engineering and financial, that had been made by the city of Seattle on the Cedar River and the Skagit.

Municipal ownership in the Southwest was discussed by Ralph Criswell, city councilman, Los Angeles, and active in the Bureau of Power and Light in that city. Touching on the history of the present development by the city of 118,000 hp. in five plants located along the 234-mile aqueduct from the Owens River to Los Angeles, he showed how this development had been a side issue to the problem of supplying domestic water to the city. Referring to the cost of power at the central receiving station in the city, he stated that 40 per cent of the total power distributed by the city was generated by it at a cost of 3.3 mills per kw-hr., and that 60 per cent was received from the Southern California Edison Company for 8 mills. Later discussion from the floor brought out the fact that only the cost of forebays, penstocks and auxiliary hydraulic equipment along the aqueduct incident to power development had been charged to the investment in power plants, and that no part of the 190 odd miles of aqueduct proper from the head works to the first plant had been so charged, all of this cost having been absorbed by the domestic water system.

Mr. Criswell urged the development of 600,000 hp. on the Colorado River by means of the Boulder dam, that he said could be delivered in Los Angeles at less than 3.5 mills per kw-hr., covering all costs except possible royalties to the United States government or to the states of Nevada and Colorado. He stated such developments should be undertaken by a government agency rather than by private enterprise on account of the risks involved.

Among the resolutions passed by the convention was one covering municipal ownership, that in its key sentence said:

"We believe that local issues frequently take on a character which obscures the great fundamental principles which should determine the course of our industrial and political life. Among these principles is that of preserving to individuals the maximum opportunity for enterprising industry in order to insure to society the advantages of individual initiative. This is a cardinal principle already adopted by the National Chamber and it has our approval."

Another resolution covered the question of water conservation and control.

Insull Medal Awarded Employee of California Oregon Co.

At a fitting ceremony held Dec. 1 Howard Dynan of the California Oregon Power Company, Medford, Ore., was presented with the Insull medal for the resuscitation of Bert T. Green, a fellow employee. While working on a pole Mr. Green accidentally came in contact with a wire of high voltage, and Mr. Dynan applied the Schaefer prone-pressure method of resuscitation, thereby saving Mr. Green's life.

John B. Fisken, consulting engineer, The Washington Water Power Company, Spokane, officiated at the ceremony as a representative of the accident prevention committee of the National Electric Light Association.

Plans Announced for California Water Resources Survey

Following a conference in San Francisco with the advisory committee of the California department of engineering and irrigation, Paul Bailey, assistant state engineer, announced plans for the continuation of the water resources survey which was started about four years ago. At the last session of the state legislature $150,000 was appropriated to carry on the work. The program outlined by Mr. Bailey is as follows:

Location on each of the main streams, of the most favorable reservoir site at the edge of the valley floors, that will serve to re-equalize the stream flow, after its use in the mountain areas for power, mining or other purposes, to the needs of dodestic, industrial, irrigation, navigation and other uses on the plains below.

Determination of the cost of these foothill reservoirs and their values for all purposes, including the conservation of water, power development, flood control, storing of mining debris, etc., and their manner of operation for securing the greatest public benefits.

Underground water survey of southern California and the southern San Joaquin valley.

General layout of a co-ordinated plan for the ultimate irrigation, drainage, control of floods and reclamation of the great central valley.

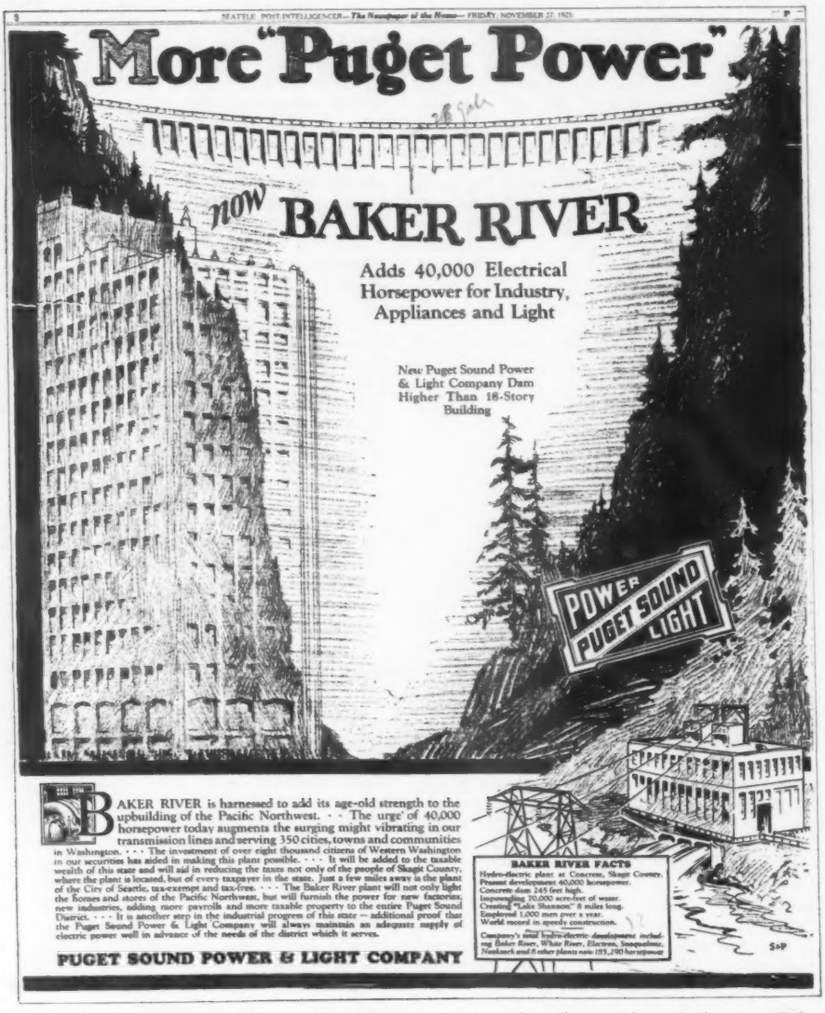
General layout of a co-ordinated plan for the ultimate supply of water for all purposes in southern California and the control of floods.

Division of the general plans into units that will provide an economic program of progressive development.

The object of the survey is given as "the development of a co-ordinated plan for developing California's waters for all purposes to secure the greatest public benefit with the lowest cost to the people of the state."

The advisory committee is composed of Louis C. Hill, William Mulholland, J. B. Lippincott, B. A. Etcheverry, Walter Huber, F. C. Herrmann, A. J. Cleary, August Kempkey and G. A. Elliott.

Puget Sound Power & Light Company Acquires New Property.—The Sequim Light & Power Company, Sequim, Wash., has sold its plant and franchise to the Puget Sound Power & Light Company, Seattle, for the sum of $80,000. The plant was owned by Joseph L. Keeler, who will become representative of the company's interests on the Olympic peninsula, with headquarters in Bremerton.


More "Puget Power"
NOW BAKER RIVER
Adds 40,000 Electrical Horsepower for Industry, Appliances and Light
New Puget Sound Power & Light Company Dam Higher Than 18-Story Building
POWER PUGET SOUND LIGHT
BAKER RIVER is harnessed to add its age-old strength to the upbuilding of the Pacific Northwest. The urge of 40,000 horsepower today augments the surging might vibrating in our transmission lines and serving 350 cities, towns and communities in Washington. The investment of over eight thousand citizens of Western Washington in our securities has aided in making this plant possible. It will be added to the taxable wealth of this state and will aid in reducing the taxes not only of the people of Skagit County, where the plant is located, but of every taxpayer in the state. Just a few miles away is the plant of the City of Seattle, tax-exempt and tax-free. The Baker River plant will not only light the homes and stores of the Pacific Northwest, but will furnish the power for new factories, new industries, adding more payrolls and more taxable property to the entire Puget Sound District. It is another step in the industrial progress of this state — additional proof that the Puget Sound Power & Light Company will always maintain an adequate supply of electric power well in advance of the needs of the district which it serves.
BAKER RIVER FACTS
PUGET SOUND POWER & LIGHT COMPANY

Full-page advertisement run in the Seattle papers announcing the opening of the new Baker River plant of the Puget Sound Power & Light Company.

Personnel Changes in Edison Commercial Department

Several changes in the personnel of its commercial department have been announced by the Southern California Edison Company, Los Angeles. These changes, which are effective Dec. 1, are as follows:

Ray I. Carruthers is to transfer from Visalia, where he has been district manager since 1918, to the general offices in Los Angeles as assistant sales manager. Mr. Carruthers joined the Edison company in 1910 as a lighting salesman and has progressed steadily. D. H. Rowan, district manager in Lankershim, takes Mr. Carruthers' place in Visalia. Mr. Rowan began as a greater service representative in the Vernon district, later transferring to Lankershim as district manager. Ray Whitson, assistant district manager at Santa Monica, is to succeed Mr. Rowan. Mr. Whitson began work with the Edison company in 1907 as meter tester, transferring shortly to the commercial department in which he has remained. C. B. Eaton, chief clerk in Monrovia, is to transfer to Santa Monica in the same capacity. B. A. Seymour, chief clerk at Redlands, goes to Monrovia, while Erva K. Smith from the Montebello district, is to become chief clerk at Redlands. Both Mr. Eaton and Mr. Seymour have had ten years service with the company, but Mr. Smith is relatively a newcomer, having had less than three years service.

Baker River Comes in on Puget Sound System Nov. 19

The new Baker River plant of the Puget Sound Power & Light Company, Seattle, started to operate on Nov. 19, 1925, when the water behind the dam reached a level sufficient to fill the pressure tunnel and was turned through one of the 20,000-hp. turbine and generator units, there being sufficient head to generate about 10,000 kw. The opening in the bottom of the dam had been sealed some time prior to this date, and the water in the reservoir had been rising slowly.

Owing to the dearth of rainfall during most of October and early November, which was far below normal over the entire Northwest, the flow of Baker River was at a low stage for this time of year, and the process of filling the reservoir was slower than might have been expected. Torrential rains occurring toward the middle of November, however, relieved the situation to the extent that the plant was able to come in on the company's system on the date stated. Continued rise of the head behind the dam is hastening the generation of full load by both units. No difficulty in the operation of any of the equipment has been experienced, according to W. D. Shannon, superintendent, Stone & Webster, Inc., builders of the plant.

Electric Locomotives Ordered for Chile.—The Anaconda Copper Company has placed an order for thirteen Westinghouse electric locomotives for use on the lines of its subsidiary, the Chile Exploration Company. The electric locomotives will replace steam equipment on the company's property at Chiquimata, Chile. Operation will be by combination third rail, trolley and storage battery.

New Substation to Be Erected by San Diego Utility

One of the outstanding features of the 1926 construction program of the San Diego Consolidated Gas & Electric Company is a new substation, work on which will begin early in the new year. This will be known as "Substation F" and will be located in the half block south of El Cajon Avenue between Iowa and Boundary Streets.

Plans for the building and apparatus are now under way in the Chicago offices of the Byllesby Engineering & Management Corporation. A two-story structure, the building will cover an area approximately 30 x 70 ft., with a cable subway in the basement. As yet the character of architecture has not been decided upon, but it is planned to make the substation harmonize with the general character of buildings in the residence district in which it is located.

Substation F will feed the district north of Redwood Street and east of Park Boulevard, including South Park, East San Diego, Normal Heights and Kensington Park, the initial transformer capacity being 3,750 kw. at 4,000 volts. The use of supervisory control for this station will be an innovation on the San Diego Consolidated Gas & Electric Company's system.

All outgoing feeders will be underground to suitable cable poles located at some distance from the station in order to avoid overhead congestion. Street-lighting equipment and regulators will be installed on the second floor, the ground floor accommodating the switches. A suitable storeroom and workroom also will be provided.

When completed this will give the San Diego Consolidated Gas & Electric Company one of the most modern distribution substations on the Pacific Coast.

Cartoon "Movie" Used to Show Lamp Dealers Sales Methods

"The Light Brigade" is the name of a one-reel motion picture film, in combination cartoon and photographic style, which recently has been completed by the Westinghouse Lamp Company, and now is being shown at meetings of wholesale and retail electrical dealers and central stations throughout the country. The purpose of the film is to show the dealer how advertising and merchandising lamps will increase his business.

The cast consists of cartooned lamps, representing General More Sales, Colonel Sign, Colonel Window Display, Major Direct Mail, Major Newspaper Ad, Captain Lamp Demonstrator and Lieutenant E. Contract.

The film opens with photographic views of the lamp factories, showing cartooned lamp figures emerging from the exits. The lamps tell how far one day's output would reach, end to end, and while they are demonstrating this by lying down on the job, General More Sales and his staff come along and order them to get busy.

From that point, the lamp soldiers undertake, one at a time, the improvement of the lighting and display of stores, windows, signs, street lights, newspaper advertising, direct-mail advertising, lamp demonstrations and factory lighting. Each officer of the "Light Brigade" is assigned the improvement of one of the foregoing. Verity is lent the proceedings by the device of fading out the changed cartoon store into a photographic real store thus arranged.

Engineer Honored by National Commerce Body

George Clinton Ward, vice-president in charge of construction of the Southern California Edison Company, and his associates were honored Dec. 1. by the Western Division of the United States Chamber of Commerce, which was then in session in Los Angeles. Mr. Ward was presented a bronze me-

Bronze medallion, mounted on the last piece of granite blasted from Florence Lake tunnel, presented to George Clinton Ward by the U. S. Chamber of Commerce, Western Division.

dallion mounted on the last piece of granite blasted from the Florence Lake tunnel.

Paul Shoup, vice-president of the Southern Pacific Company and vice-president of the Chamber, made the presentation. He recited the achievement of Mr. Ward and his associates in building the world-famous tunnel under the Kaiser Mountains in the high Sierra of California that was commenced Aug. 12, 1920, and completed Feb. 18, 1925, making a new world record for this type of construction.

The medallion bears this inscription: "By their works ye shall know them!"

Helena Company Goes into Hands of Receiver

With the first mortgage bonds in the amount of $894,000 due Sept. 30, 1925, and unpaid, the Helena Railway & Light Company, Helena, Mont., was forced into the hands of a received by petition of the general creditors Nov. 2. This mortgage covers the entire property of the company including a railway property that had been unproductive for some time. It is understood that the principal reason the company was unable to refinance its mortgage on the maturity of its bonds was that the bond issue represented too large a proportion of the productive property consisting of the electric and gas systems. Further hampering any possible financing at that time was the circumstance that the company faced damage suits amounting to $150,000 arising out of a wreck last December.

A. T. Schultz, formerly manager of the company, has been appointed receiver and continues actively in charge of operations. The bondholders are suing to foreclose the mortgage and have the receivership consolidated.

Customer-Owner Share Sale Gets Big Response in Colorado

The recent customer-ownership campaign of the Public Service Company of Colorado resulted in the sale of 14,620 shares of Public Service and Cities Service preferred stock. The campaign, according to company officials, was highly successful, being almost double in volume the quota established for the campaign by the New York headquarters of the company.

Although the operating division led by V. L. Board, general superintendent, sold the largest number of shares, the commercial department with C. A. Semrad, vice-president and commercial manager, as general, topped the score with the largest sales per employee and in exceeding its division quota. J. E. Loiseau's accounting army ranked second. Guy W. Faller, vice-president, was in charge of the campaign, which for the first time was tied in with similar campaigns on all of the other Doherty properties.

Report of Progress on Exchequer Dam and Power House

Good progress is being made in the construction of the Exchequer dam and power house for the Merced Irrigation District in process of erection on the Merced River 35 miles east of Merced. The dam, which will be 330 ft. high with a crest length of 955 ft., is nearly finished, about 60,000 cu. yd. of concrete being necessary to complete the structure. Openings have been left in the dam for the passage of winter floods, and it is anticipated that these openings will be closed about March 15, 1926. The relocation of 17 miles of the route of the Yosemite Valley Railroad, which originally ran through the reservoir site, is expected to be finished at about the same time.

Valves, penstocks and water wheels have been installed at the power house, and nearly all the electrical equipment is on the ground. The entire output of the plant will be absorbed at the switchboard of the Exchequer power house by the San Joaquin Light & Power Corporation, Fresno.

Substation Explosion and Fire Causes $30,000 Damage

Failure of an outgoing feed cable (2,200-volt) at a pothead in a distribution substation of the Los Angeles Bureau of Power and Light on the evening of Nov. 24 caused a short circuit which resulted in a voltage regulator exploding and setting fire to the substation. It is estimated that $30,000 will cover the damage done. The explosion and fire destroyed the low-tension equipment entirely, but the high-tension equipment was not affected seriously.

E. L. Goodwin, the operator in charge, was in another part of the station when the heavy explosion occurred and suffered only slight burns in attempting to extinguish the blaze.

Service in Highland Park, Sierra Vista, Eagle Rock and Garvanza was interrupted for six hours. Officials of the power bureau state that the unit-type construction used in building made it possible for the repair crew to get the station back on the line in this remarkably short time.

News Briefs

New Substation for Longview, Wash.—The Longview Public Service Company, Longview, Wash., has under construction an automatic power and light substation which is to cost $50,000. It will supply power and light for Longview proper, getting its energy from the Long-Bell power plant. The building designed by A. N. Torbitt of Longview will be of reinforced concrete with ground dimensions of 50 x 50 ft. and height of 32½ ft. The equipment will include transformers, automatic switches and metering equipment of the latest type. The station is about to be placed in operation.

Underwriters' Laboratories Report on "Romex" Cable.—Acting on the recommendation of the engineering staff of the Underwriters' Laboratories, the Electrical Council of that body on Nov. 4 issued a notice to the industry that "Romex" cable, manufactured by the Rome Wire Company, had been examined and tested and found to comply with Underwriters' Laboratories' tentative specifications for non-metallic sheathed cables. The notice also points out that there is now a rule in the Code forbidding the use of twin wires and that the Article 5 committee now is considering necessary installation rules.

Appliance Information Hand Book to be Withdrawn from Print.—"Hand Book of Electrical Appliance Information," published by the California Electrical Bureau is about to be taken off the press. A final notice has been sent out to all electrical development leagues and others who may be interested directing their attention to this fact. The opportunity to procure these books will pass with the withdrawal of the book from print, and anyone interested in securing additional copies is urged to write the bureau at once.

Klickitat River Power Site Requested.—Permit to construct a hydroelectric power plant on the Klickitat River in Klickitat County, Wash., to cost between $4,000,000 and $5,000,000 is sought by Thomas A. Murray and M. Lynatt, Portland, Ore., according to an application filed with R. K. Tiffany, Washington supervisor of hydaulics. The applicants seek to divert 10,000 sec.-ft. of water from the Klickitat River. The water is to be diverted at a 150-ft. head, and it is estimated that 60,000 hp. will be developed.

Pasadena Light Bureau Rents Extra Office Space.—Need for additional space in which to handle the work of the municipal light and power department of Pasadena has caused the board of directors to authorize the rental of twenty-one rooms in the Central Building on North Raymond Avenue for a period of two years. This move is expected to take care of the department until the new city hall on Garfield Avenue is ready for occupancy. The department now is occupying the new quarters.

Idaho Plants Purchased by Eastern Company.—The Wood River Power Company, of Hailey and Bellevue, Idaho, for the last eight years owned by Irvin E. Rockwell of Bellevue, has been sold to the Consumers' Public Service Corporation of Delaware. The price was between $400 000 and $500,000. E. W. Rising of Hailey, former vice-president and general manager, succeeds Mr. Rockwell as president of the local company and also becomes president of the Consumers' Public Service Corporation. The principal offices of this company are in Chicago. The Wood River Power Company furnishes power to the towns of Hailey and Bellevue and to a number of large mining properties in this section.

Fallon, Nevada, Irrigation District to Build New Plant.—For the purpose of saving water for irrigation during the winter season, effecting a complete distribution of electric power to all settlements of the Newlands project, including Fernley, Hazen and Swingle Beach, and reclaiming 10.000 acres near Fallon, the directors of the Truckee-Carson Irrigation District have taken first steps to acquire the present power holdings, according to recent press dispatches. It is planned to build a new power generating plant between Fallon and Lahontan at a cost of $250,000, and secure current during the winter months from the Pacific Gas and Electric Company of California, or the Truckee River Power Company.

Extension of Underground Service Area in Seattle Sought.—A crusade against unsightly poles and wires on Seattle's public streets and alleys has been started by John E. Carroll, city councilman, who has asked Clark R. Jackson, superintendent of public utilities, to recommend a program to the city council for the expansion of the city's underground conduit area. Mr. Carroll believes that this area should include not only the downtown section, but also those streets where property owners have assessed themselves to establish ornate street lighting facilities.

Power Company Files Articles of Incorporation.—The American River Hydroelectric Company is the name of a new power company for which articles of incorporation were filed recently with the secretary of state at Sacramento, Calif. The company has a capital stock of $5,000,000 and contemplates the development of a power project on a site near Folsom prison. The incorporators were given as Stephen E. Kiefer, Berkeley; J. A. Talbot, Los Angeles; A. J. Cleary, San Francisco; and E. C. Chapman, Corte Madera.

Hearing on Edison Company Property Valuation Postponed.—The California State Railroad Commission has postponed the hearing of the case of the valuation of the properties of the Southern California Edison Company located in territory which has been annexed by the city of Los Angeles. The hearing, which was to have been held Nov. 2, has been set for Jan. 26 in order to give further time for the praparation of the report.

El Paso Electric Company Completes Substation.—The El Paso Electric Company, which recently changed its name from the El Paso Electric Railway Company, has completed the installation of a 1,500-kva. substation in El Paso. The station, at present having an installation of three 500-kva. transformers, is so arranged that an equal number of the same size units may be added at a later date. Service to the station is at 13 kv. by two lines, which under normal conditions are tied together, but in case of failure of either line relays disconnect the line temporarily out of service. Distribution from the substation is over two 4,000-volt circuits. Prior to the installation of the new station the system in the district was two-phase four-wire. The new system is three-phase four-wire and necessitated the changing of a considerable number of connections on transformers and power loads.

Pacific Gas and Electric Company Made Co-Licensee with Nevada Irrigation District.—In the license prepared for the signature of the Nevada Irrigation District covering the rights the Federal Power Commission has awarded to that interest (Journal of Electricity, Oct. 15, p. 307) the Pacific Gas and Electric Company is made a co-licensee, to the extent of its contract with the irrigation district. That contract provides for the power company to make payment to the district in proportion to the amount of power it is able to develop with district water. Another condition of the license is that the commission reserve jurisdiction over all water of the Middle Yuba that is not used actually by the licensee.

Company Organized to Take Over Power and Water Plants in New Mexico and Texas.—The Southwestern Public Service Company has been organized to take over a number of power and water plants in New Mexico and western Texas by C. M. Einhart and associates of the Roswell Public Service Company, Roswell, N. M. The Amarillo, Texas, plant has been purchased from the Doherty company, and franchises have been secured in several towns to which transmission extensions will be made. Loving, N. M., has granted a franchise to the company and will have a line run to that town from Otis. It is understood that the merger and new acquisitions will amount to a two million dollar deal.

Oak Harbor and Whidby Island to Be Served.—The Puget Sound Power & Light Company, Seattle, plans to extend its service from Anacortes to Oak Harbor, Wash., and on to Coupeville on Whidby Island. The lines will be extended from Anacortes to Deception Pass, and from this point a submarine cable will be laid to supply the northern half of Whidby Island with current.

Edison Company to Erect Two Combination Warehouse and Garage Buildings.—The Southern California Edison Company plans to construct two new combination warehouse and garage buildings, one at 2306 Orange Street, Alhambra, and the other at the corner of Glasgow and Orange Street, Inglewood. Each structure will cost approximately $30,000.

Northwest Electric Light & Power Association

Journal to Intensify Editorial Service in Northwest

In advising members of the Northwest Electric Light and Power Association regarding the arrangement which has just been perfected with the Journal of Electricity and that organization, Lewis A. Lewis, president of the association, has issued the following statement:

"The Northwest Electric Light and Power Association has effected, through its executive committee, an arrangement with the Journal of Electricity whereby every member of the association becomes a subscriber to the Journal without raising dues or otherwise burdening member companies or individual members. In this connection the Journal proposes to present news concerning association activities, with the view to keeping the membership at large informed of the work of the various sections and committees.

"In addition the arrangement provides for the printing of the convention papers and reports in a regular issue preceding the convention, and later the publishing by the Journal of the proceedings in book form.

"The executive committee felt that this arrangement in its entirety would benefit the association by assisting it to do a better job for its member companies and consequently for the industry."

Northwest Convention to Be Held in Spokane June 16-19

At a meeting of the executive committee of the Northwest association in Portland, Dec. 4, 1925, the dates for the 1926 convention of the Northwest Electric Light and Power Association were set at June 16, 17, 18 and 19 in Spokane. That week, following the week of the Pacific Coast Electrical Association Convention in Los Angeles, was chosen so that officials of the National Electric Light Association and other Eastern visitors to the southern convention could plan to return via the Northwest stopping off at Spokane for the convention there. No plans have been announced yet as to the program or entertainment.

Commercial Section to Hold Group Meeting in February

At a meeting of the executive committee of the Commercial Section of the Northwest Electric Light and Power Association, held at Portland Dec. 3, it was decided to hold a general group meeting of the section in Spokane in February, though no definite date has yet been set. This meeting is to be a sort of round-table discussion of various subjects to be presented by assignment and is to last two days. At the Portland meeting all committee chairmen reported on progress in the work of their committees, indicating that several subjects of interest were being studied.

Appointment of chairmen of the subcommittees of the section, recently announced by P. M. Parry, commercial manager, Utah Power & Light Company, Salt Lake City, chairman of the section, include the following: power committee—J. D. Scott, commercial engineer, Portland Electric Power Company, Portland; lighting committee—W. M. Shepard, vice-president and general agent, the California Oregon Power Company, Medford; customers relations committee—A. C. McMicken, sales manager, Portland Electric Power Company, Portland; electric cooking and heating committee—R. B. McElroy, assistant sales manager, The Washington Water Power Company, Spokane; appliance committee—V. H. Moon, appliance sales superintendent, Pacific Power & Light Company, Portland; domestic electric refrigeration committee—J. F. Orr, sales manager, Idaho Power Company, Boise; transportation committee—R. H. Ashworth, rate engineer, Utah Power & Light Company, Salt Lake City; electric range survey committee—Lewis A. Lewis, sales manager, The Washington Water Power Company, Spokane.

Executive Committee Public Relations Section Meets

Reporting the progress of the work of the various committees of the Public Relations Section of the Northwest Electric Light and Power Association, several chairmen of the subcommittees attended a meeting of the executive committee of that section held in Portland, Dec. 4.

A new committee this year is the industrial relations committee, headed by Col. H. G. Winsor, personnel officer, Puget Sound Power & Light Company, Seattle, who stated that his committee intended to study the following five subjects: Employment, compensation, training and education, thrift plans, and health. Mrs. L. A. McArthur, Portland, chairman of the Women's Committee, reported that fourteen groups of women in different localities have been organized. She also reported on the results of the Salt Lake meeting in October.

Considerable discussion as to the kind of public speaking most desirable was aroused by the report of J. B. Fisken, consulting engineer, The Washington Water Power Company, Spokane, chairman of committee in charge of public speaking. Another report bringing forth discussion was that of Dwight Ware, manager, Puget Sound Power & Light Securities Company, Seattle, chairman of the customer-ownership committee. Both these chairmen left the meeting with valuable suggestions to guide committee activities for the year.

W. H. Ude, director of public relations, The Washington Water Power Company, Spokane, chairman of the section, reported for the committee on relations with educational institutions, in the absence of its chairman, A. J. Priest, attorney for the Idaho Power Company, Boise. The meeting was addressed by Lewis A. Lewis, sales manager, The Washington Water Power Company, president of the association, who told of his recent trip to Chicago where he attended a meeting of the Public Relations National Section.

Cooking and Heating Committee Attracted by Range Tests

A meeting of considerable interest to both the Northwest and Pacific Coast associations was that of the cooking and heating committee of the Commercial National Section of the Northwest Electric Light and Power Association held at Salt Lake City, Dec. 7 and 8, 1925. C. O. Dunton, Central Illinois Power Company, Springfield, Ill., chairman, determined to hold this meeting in the Northwest on account of the tests being conducted there by the range survey committee of the Northwest association and now nearing completion. A final report of the results of the test is to be prepared for presentation at the National Electric Light Association convention next May.

As a result of the Salt Lake meeting, the Pacific Coast Electrical Association will be invited to undertake a similar survey on metered water heating in California next year.

P.C.E.A. News

Technical Section Announces January Meetings

It is plannned that the Fairmont Hotel in San Francisco will be the seat of action for the next regular conclave of the Technical Section. The dates for the meetings have been confirmed as suggested at the Los Angeles meetings in September, Jan. 13, 14 and 15.

Serial Reports Published by Technical Section

A serial report entitled "First-Aid Talks" has been published and released by the accident prevention committee, Technical National Section, N.E.L.A. The first-aid talks contained in this report are intended as a guide and text book for those teaching first aid. The information is presented in non-technical terms so that ordinary laymen, such as managers or superintendents, can give the course to their employees. There is some excellent material in this publication. The price to members is 40 cents.

Four serial reports have been published by the prime movers committee of the Technical National Section, N.E.L.A., and are ready for distribution. These reports are: Power Station Heat Balance; Development of Equipment; Pulverized Fuel; and Higher Steam Pressure Than Temperature. All of these are credited to the 1924-25 committee. The price to members of each of these reports is 40 cents, 10 cents, 45 cents and 30 cents, respectively.

News of the Electragists

California Electragists Have Interesting Meeting at Sacramento

Association work, trade policy, business problems, industrial lighting, and the Red Seal plan were among the major topics discussed at the quarterly convention of the northern division of the California Electragists that was held at the Senator Hotel, Sacramento, Dec. 5, 1925.

The executive committee held its meeting at 10 a.m. It was decided that an executive committee consisting of one member from each district

Edward Martin, secretary of the Northern Division of the California Electragists, was very active at the meeting held at Sacramento, Dec. 5. Mr. Martin is proprietor of the Sterling Electrical Company of San Francisco

should be appointed by the chairman. The membership roll of the electragists will be sent to the power company representative in each district in order to identify the members and bring about a closer co-operation between them and the power companies.

Members' Meeting

The closed members' meeting was called to order by C. Felix Butte, president, at 11 a.m. with thirty-seven members in attendance. Mr. Butte appointed a number of committees made up of members in the outlying districts as well as those in the centers of population. He stated that in this way it was hoped that a larger number of the members would be in closer touch with the activities of the organization.

C. J. Geisbush, executive secretary of the southern division of the California Electragists, addressed the members on the electragist movement with special emphasis on the trade policy of the electragists.

H. C. Reid, H. C. Reid & Company, San Francisco, told the members of the strides that have been made by the San Francisco Association of Electrical Contractors and Dealers in eliminating errors in estimating and of other association activities.

C. L. Chamblin reported on his attendance at the meeting of the executive committee of the National Electric Light Association. He pointed out the fact that the electragist movement is attracting the attention of this important branch of the industry to the extent that it insists on having an electragist on its executive committee.

H. H. Courtright, Valley Electrical Supply Company, Fresno, urged that an effort be made toward having segregated figures taken for electrical work instead of having them included in the general figure for the entire building.

J. C. Hobrecht, J. C. Hobrecht Company, Sacramento, spoke on the subject of electrical merchandising.

General Open Meeting

The general open meeting was held in the afternoon at 2:30. C. Felix Butte, president, outlined his plan of conducting the Association during his term in office. He stated that he hoped to build up the attendance at the meetings by having a larger number of the members take an active part in them. A more harmonious personal relationship between members was urged. Trade policy as outlined by the electragists was stressed as being worthy of the support of every member. Mr. Butte stated that all electragists should maintain a high standard of business principles at all times. The work of the California Electrical Bureau was highly praised, and the administration pledged itself to support its activities in every way possible. The Red Seal plan will be carried on aggressively and the co-operation of the members was requested.

L. Siebert (right), Drendell Electrical Manufacturing Company, San Francisco, who was winner of the golf tournament held at the meeting of the Northern Division of the California Electragists in Sacramento, Dec. 5, and S. P. Russell of the H. B. Squires Company of San Francisco, who won second place.

H. N. Nelson, Enterprise Electric Works, San Francisco, read a paper containing extracts from the business guide, "Know Your Business," which was presented at the Lebec Convention of the southern division of the California Electragists and which has since been published by the Electrical Supply Jobbers.

Clark Baker of the National Lamp Works addressed the meeting on the industrial lighting plan. He stated an advertising program is being conducted nationally which is using twenty-three publications. Three mailing folders and one booklet have been prepared as follow-up material in response to definite requests. Mr. Baker said results already have been obtained in the form of requests for pamphlets, layouts and actual sales of installations. He urged that all electragists get in touch with the committee in their district if this had not been done.

Clyde Chamblin reported on the status of the Red Seal plan. He stated

C. J. (Cy) Geisbush, executive secretary of the Southern Division of the California Electragists, drove all night in order to be in Sacramento in time for the meetings of the Northern Division. He was accompanied by Paul H. Needham of Beverly Hills and Lee C. Baltzelle of the J. J. Farley Electric Company, Fullerton.

the program probably will be launched in full force after the first of the year. He urged members of the industry to sell themselves and install the equipment in their own homes before trying to sell it to the public.

Victor W. Hartley, executive secretary of the California Electrical Bureau, also spoke on the Red Seal plan and stated the Real Estate Association had requested for its publications several articles on how it can use the Red Seal plan in selling homes.

C. J. Geisbush outlined his viewpoint on the electragist movement based on two years observation in southern California. He stated it is building up a keen sense of trade loyalty and pride in the work of the members and an appreciation of their position in the industry. He also spoke of the increased interest that is being taken in the movement.

Seventy electragists from the San Francisco Bay district chartered the steamer Navajo to make the trip, leaving San Francisco Friday night and returning Saturday night.

L. R. Wheeler, formerly a member of the **Los Angeles Electric Works** of Los Angeles, has sold his interests in that firm and purchased the **Griffith Machine Works.** In addition to conducting a general motor repair department he will manufacture a new electric drill.

Northwest Electrical Inspectors Will Organize in January

With the object of reducing fire and personal hazards from electrical causes, those interested in electrical inspection in Oregon and Washington are organizing the Northwest Association of Electrical Inspectors, and the first meeting is to be in Portland, Jan. 11-12, 1926. Leaders in the movement are H. A. Patton, electrical engineer, Washington Surveying and Rating Bureau, Seattle, and F. D. Weber, electrical engineer, Oregon Insurance Rating Bureau, Portland. Mr. Weber, whose mail address is Box 745, Portland, Ore., is acting as temporary secretary of the proposed organization and already has received favorable replies to his appeal indicating that some twenty individuals in each state will join as active members.

A tentative constitution providing for an organization modeled after the California association has been drafted to be passed or amended at the January meeting. This provides for three classes of membership: active, associate and industrial. Active members shall be persons engaged in inspecting or supervising inspection of electrical installations in behalf of city, county, state or national authorities, or of insurance organizations. Associate members shall be persons engaged in inspection in behalf of public service agencies other than the above, while industrial membership shall include those engaged in electrical industry as engineers, contractors, manufacturers, and members of electric public utility companies.

With the desire to provide a particularly interesting program at the first meeting, the organizers have been active in inducing some nationally known men of the industry as well as local authorities to attend and present papers on subjects pertinent to the work of the association. Among those who it seems reasonably certain will be on the program are R. J. Larrabee, engineer of the San Francisco branch of the Underwriters Laboratories, Inc., Chicago; C. W. Mitchell, electrical engineer, Board of Fire Underwriters of the Pacific, San Francisco, also secretary of the California Association of Electrical Inspectors; H. B. Kirkland, Society for Electrical Development, New York; W. J. Canada, electrical field secretary, National Fire Protection Association, New York; L. W. Going, electrical inspector, city of Portland; J. C. Caine, deputy electrical inspector, Portland; and E. B. Morrison, assistant electrical engineer, Oregon Insurance Rating Bureau, Portland.

It is understood that this program is not final nor complete, and the organizers hope that manufacturers will avail themselves of the opportunity of bringing exhibits to the meeting. The meeting will be open to all interested persons or organizations.

CALIFORNIA ELECTRAGISTS, NORTHERN DIVISION, COMMITTEES

Architects and Engineers
William Bernhardt, Berkeley.
J. H. Hilfiker, Eureka.
R. Perry, Fortuna.
L. Jeffrey, Fresno.
Chester E. Hershey, San Jose.

Code and Regulations
Victor Lemoge, San Francisco.
Sam Fingerhut, Bakersfield.
G. R. Maclaren, Fairfax.
F. Dahlquist, Ferndale.
C. Vining, Sacramento.

Convention and Meetings
Carl Strom, Alameda.
Jim Baker, Bakersfield.
H. H. Fenneman, Hayward.
R. Mixer, Lodi.
John Holt, Santa Cruz.

Cost Data
George Smith, San Francisco.
E. E. Elzen, Fresno.
H. E. Howard, Los Gatos.
J. C. Kerr, Manteca.
O. A. Mundell, Santa Rosa.

Credit and Accounting
C. Collonan, San Francisco
C. A. Rochester, Berkeley.
William Murphy, Stockton.
W. Eklund, San Rafael.
J. A. Foster, San Mateo.

District Activities
Clifford Prudhomme, Sacramento.
C. F. Mausser, Burlingame.
L. Stinchfield, Martinez.
S. Henderson, Turlock.
O. W. Morton, Sonoma.

Finance
H. N. Nelson, San Francisco.
W. D. Evans, Salinas.
Jack Mehrtens, San Francisco.
E. Hiester, Oakland.
G. C. Foss, Sacramento.

Golf and Outdoor Activities
Arthur Dahl, San Francisco.
C. B. Kenney, San Francisco.
L. A. Poland, Eureka.
W. Spencer, Oakland.
T. Rosenberg, Oakland.

Membership
A. K. Carson, Bakersfield.
Fred Sundberg, Eureka.
Charles Shipman, San Francisco.
Oscar Abbott, Hanford.
D. M. Bird, Chico.

Publicity
R. J. Finchley, Sacramento.
J. A. Schanbacher, Watsonville.
M. E. Ryan, Redwood City.
A. R. Hancock, Willows.
E. Milbourne, Yreka.

Standards and Data
C. W. Miller, Alameda.
T. M. Robinson, Fresno.
J. M. Nightingale, Modesto.
Walter Cox, Santa Cruz.
J. Stanovich, Watsonville.

Trade Policy
C. L. Chamblin, San Francisco.
H. H. Courtright, Fresno.
J. C. Hobrecht, Sacramento.
R. M. Butcher, San Jose.
H. W. Jacobs, Santa Rosa.

Power Companies
C. B. Kenney, San Francisco.
H. N. Nelson, San Francisco.
J. C. Carlson, San Francisco.
C. L. Chamblin, San Francisco.
J. C. Hobrecht, Sacramento.
H. H. Courtright, Fresno.

Baseball team of the Newbery Electric Corporation which won the 1925 Electric Club baseball series: this team also won the 1924 pennant. It played the 1924 and 1925 series against all electric companies in Los Angeles and lost only two games in the two years. The cup in the foreground was presented by the Electric Club of Los Angeles. Reading from left to right the men in the picture are: standing—D. D. McFarlane, "Doc" Beaton, "Matt" Clark, H. Kennedy, "Al" Blodgett, Charles Ames, Jim Heavens, Paul DeBroux; sitting—Howard Burdick, "Al" Hetchko, and Roy Thurston

Colton Electric Company has moved to a new location at 282 North Eighth Street, Colton, Calif. It was formerly at 170 West I Street.

The Fellstrom Electric Company, Seattle, has moved from its location at 1428 Railroad Avenue to larger quarters at 2131 Western Avenue. The firm specializes in electric motor sales and repairs as well as general electric contracting. **Carl E. Fellstrom,** manager, has been in this line of work for twenty-three years.

Edmund A. Cullen has been named to succeed **Thomas W. Nixon** as the advertising manager of the monthly bulletin issued by the **Denver Electrical Contractors' Association.**

Santa Ana Electric Company has been opened at 118 E. Fourth Street, Santa Ana, Calif., by **E. R. Christensen.** Mr. Christensen was formerly with the **Cope Electric Company.**

T. I. Smith has remodeled his entire store at 631 E. Broadway, Glendale, Calif. The new store is double the size of the old one and has a very practical arrangement. Separate booths for showing fixtures and demonstrating radio are a feature of the new store. An opening was held on Nov. 21 and a great number of customers and prospective customers viewed the new store.

Book Reviews

NIAGARA IN POLITICS

By JAMES MAVOR, M.A., Ph.D., F.R. S.C., Emeritus Professor of Political Economy in the University of Toronto. Cloth; 5¼ by 7½ in.; 255 pp. E. P. Dutton & Company, New York, N. Y. $2.00.

Perhaps no political organization has aroused greater comment and discussion in this country and in Canada than the Ontario Hydro-Electric Commission. Because it is the greatest publicly owned plant in the world, its organization and operation have been the subject of papers and addresses whenever and wherever municipal or state ownership of public utilities has been broached. In this book the late Dr. James Mavor, author of the "Economic History of Russia," endeavors to prove by collected evidence that the Ontario Hydro-Electric Commission has tried through the help of politics to eliminate competition and to make itself an absolute monopoly at the expense of the public interest and pocketbook.

The author contends that in the first place the Commission is not a typical example of "public ownership" at all but is "really an attempt on the part of a small number of politicians to establish an industrial monopoly and to manage this monopoly in such a manner as to keep themselves in power." To quote from the introduction:

"The Hydro-Electric Commission of Ontario affords in the course of its history very vivid instances of the use to which a combination of economical monopoly and political power may be put. Since the Commission was established, there have been one Farmer's Government and three Conservative Governments. All of these, as well as the contemporary oppositions, have been under the control of the Hydro-Electric Commission. All of the Governments, often greatly against their will, have been obliged to find the enormous sums of money demanded by the Commission for the carrying out of its projects. All of the Governments have repeatedly been called upon to legalize by ex post facto legislation, acts done by the Hydro Commission in flagrant violation of Statute Law and even of the Acts passed in behalf of the Hydro itself. In attempts at self-protection, the Governments have nominated members of the Commission committed to their interests."

Efforts at bringing to light facts regarding the operations of the Commission have met with failure because the Hydro held absolute control of the provincial government. Regarding this phase of its operation Dr. Mavor says:

". . . Government after Government in self-protection against condemnatory criticism, which came naturally from the quarters in which they were attempting to raise the necessary loans, appointed special Commissions of Inquiry and special audits of the Hydro-Electric accounts. In spite of disclosures which would have ended the career of any ordinary politicians, these investigations all somehow missed fire. Successive governments have remained tied to the Hydro-Electric enterprise, with very inadequate control over it, yet full responsibility for it to the people, bound to find whatever extravagant amounts its administration demanded and hoping for some miracle by which they might be relieved from what had become an almost intolerable incubus."

Discussing the leasing of the natural resources of a nation and regulation of the parties to which leases are made, Dr. Mavor says:

"When a Government leases or sells the natural resources of a country it retains it visitatorial power or right of inspection and criticism. This right is inherent in the Government and may be exercsed in the public interest in respect to any public or private enterprise whatsoever. The Government as trustee for the public is ex-officio critic. Whenever the Government, either as a Government or in the form of an organ created by it and insusceptible of differentiation from it, assumes operation of an industry, especially when to this operation there is added the incident of monopoly, there ceases to be any independent official critic of that industry. Moreover, anyone within the Government industry or outside of it who ventures to criticize the industrial proceedings of the Government or the financial soundness of its enterprises is denounced as an enemy of the people, as an agent of profiteers or of the interests of capital or whatnot. Criticism under these circumstances is either rare or non-existent. An auditor who dared in the course of his professional duties to object to expenditure would be presented with the alternative of withdrawing his objection or adversely affecting his professional career. An engineer who pointed out some weakness in the technical aspects of the Government undertaking need not hope for Government patronage in the future. A newspaper which ventured to criticize the undertaking would speedily be deprived of Government advertising. By these means it is very clear that a Government which embarks upon a large scale in industrial enterprise encounters strong temptations to act in an arbitrary manner. It cannot afford to have the defects of its administration disclosed. It must close the mouths of critics. In this way, the Government and its enterprises are defended by a reign of terror, varying in its incidents according to the country and to the stage of social development. Such a reign of terror has been established by the Ontario Hydro-Electric. Its newspapers can be counted on to suppress information unfavorable to it and to abuse anyone who ventures to raise his voice upon its imperfections; its advocates in the municipalities and in the local legislature denounce everybody who calls it in question, demanding his dismissal from any public office which he may occupy and pursuing him with all the ruthless invective at their command. By these means the Hydro-Electric has acquired a strangle hold upon Ontario, plunging it into over two hundred millions of debt and embarrassing its finances and its credit."

Overfinancing and mismanagement, together with an extraordinary amount of power, have opened the door to temptations which officials of the Commission have not had the moral stamina to resist, the author contends.

Commenting upon the much discussed question of rates, he states:

"The popularity of the Hydro-Electric has been promoted by the ingenious device of giving domestic light service in the centers of population at abnormally low rates while the rates for power are relatively high within the same areas. In the rural districts where the population is scanty and the votes distributed, the rates alike for domestic service and for power are abnormally high. Only the monopoly of supply which the Hydro has established renders such rates possible. There is no appeal and even where in some cases gross injustice has been perpetrated, there is no redress, for by an Act passed in the interests of the Hydro, the law courts are closed against any suit that may be brought against it."

In a brief review such statements as are quoted cannot be substantiated, but in his text Dr. Mavor offers voluminous proof for his remarks in the form of written reports, public statements by officials of the Commission and others. His case against the Commission is most complete and apparently will stand up under such refutation as those in charge of the Commission undoubtedly will attempt to make.

In recommending the book to our readers, who are vitally interested in the subject of Ontario because of the part it has played in the arguments in favor of state ownership in California, Washington and Oregon, we can say that its pages "show conclusively that the Ontario Government committeed a fatal error in permitting what was originally designed to be an investigating, inspecting and controlling department of the Government, to transform itself into a monopolistic enterprise, to legislate itself outside of the law and to conduct itself in so arbitrary a manner that it has become wholly out of place in a democratic country." G.C.T.

Electric Handbook for Petroleum Men.—To acquaint the field men of the petroleum industry with the fundamentals of electricity the Westinghouse Electric & Manufacturing Company has published a handbook on the subject. This 31-page booklet starts in with an exposition of such fundamentals as Ohm's Law and goes on through much usable information concerning methods of installing and caring for electrical equipment peculiar to the petroleum industry. Numerous diagrams and several tables are given. The publication is known as Special Publication No. 1731 and copies may be obtained from the publishers upon request.

Geological Survey Publishes Report on Colorado River.—A comprehensive report on the Colorado River has been published by the Department of the Interior based on engineering studies made by the Geological Survey. The report, known as Water Supply Paper 556, was prepared by E. C. LaRue, hydraulic engineer, who has made a study of the Colorado River for the last fifteen years. It deals with the comprehensive development of the river below the mouth of Green River, with particular reference to flood control and the development of hydroelectric power.

Meetings

Dairy Farm Electric Equipment Committee Meets

Portable motors, power study of farm-dairy plants, and inexpensive electrical sterilizers were among the important subjects considered by the Dairy-Farm Equipment Committee of the Committee on the Relation of Electricity to Agriculture which met at the Pacific Slope Dairy Show held in the Oakland Auditorium, Oakland, Calif., in November.

Development of further uses of small motors, the possible design of a good portable type, and consideration of extensions, outlets, and similar problems will be handled under the leadership of T. A. Reid of the Westinghouse Electric & Manufacturing Company. The motors which are to receive the major attention of the committee will be 3-hp. and less.

A power study of farm-dairy plants will be made by the use of a questionnaire covering the time equipment used, the power consumed, and the operations performed. Dr. J. J. Frey, chairman of the committee, stated that the co-operation of the state dairy inspectors would be extended in obtaining the detailed information required in the questionnaires.

Report on Electric Sterilizers

A. W. Farrall presented a report of the work which has been done under his direction in testing dairy sterilizers. Two manufacturers who have built electrically heated dairy sterilizers, cooperated with the committee enabling them to test these sterilizers and obtain the data contained in the report.

Both of these sterilizers were of the square galvanized iron-tank type, there being three types of covers: (1) the ordinary single-thickness removable metal cover, (2) a double-thickness insulated-type removable metal cover, and (3) a single-thickness hinge-type metal cover. All sterilizers were of the four-can size. All used electricity for heating, provision being made in the bottom of the tank for the heating element. The elements were designed for 220 volts and operated on a 220-volt circuit; the voltage varied, however, between about 226 and 240.

After carefully observing the operation of these sterilizers and computing the cost of the power actually used, the committee feels that the electrically operated sterilizer is a perfectly feasible appliance. Certain refinements are necessary which do not call for anything inconsistent with mechanical practice or for any great outlay of money. The following conclusions, subject, however, to alteration with future tests, have been arrived at:

(1) The amount of water should be kept at a minimum; (2) as large a heating unit as is practical from the standpoint of space and first cost should be used; (3) it seems advisable to use some method of heat insulation of the cover, and possibly of the tank; (4) some automatic method should be installed that will cut out the current and hold the circuit open as soon as 210 deg. F. is reached; (5) the sterilizer should be used on the same line with some such load as a 5-hp. motor, being controlled through a double-throw switch; (6) method of sterilization might be altered so as to use the power only long enough to maintain the vessels at a sufficiently high temperature for 20 minutes instead of having the power on during the entire time.

The difference in time required in using a 3-kw. heater and 5-kw. heater seems to be very much in favor of the larger unit. The smaller unit required an average of about 50 minutes while the larger unit required an average of about 21 minutes, amounting to 1.75 kw-hr. for the larger and 2.5 kw-hr. for the smaller.

The effect of insulating is shown in a test on the same sterilizer. In the first case it took 56.5 minutes to raise the water to 210 deg. F. and the second an average of 47 minutes, a saving of 9.5 minutes, or, since this was a 3-kw. element, nearly 0.8 kw-hr.

One of the manufacturers has agreed to make up a cover using air space for insulation instead of a lagged space, and further tests will be run. Permission has been obtained from several dairymen to place sterilizers on their farms and assist in keeping accurate records of the power consumed, water used, utensils sterilized, time required and other important data.

It would seem from the tests that have been run that, using a power rate of 2 cents per kw-hr., the cost of sterilization is less than 4 cents per run.

The committee also discussed the destructive effect of electric current on bacteria. A bibliography covering this subject will be prepared.

Proper illumination for barns was discussed, and the committee will offer its co-operation in the carrying on of extension work and investigation and promotion of the correct lighting for barns.

A new project was suggested by Dr. Frey which has to deal with the disposing of septic tank sludge, particularly with the trouble given by casein which clogs up the sewers. A bibliography will be prepared on this subject.

COMING EVENTS

Technical Section, P.C.E.A.—
Conclave—Fairmont Hotel, San Francisco
Jan. 13-15, 1926

California Electragists, Southern Division—
Quarterly Meeting at Catalina, Calif.
Jan. 23-24, 1926

Rocky Mountain Division, N.E.L.A.—
Section and Committee Conference
Idaho Springs, Colo.
Jan. 25-26, 1926

Electrical Men of Colorado—
State-wide meeting under sponsorship of Electrical League of Colorado
Denver, March 26, 1926

Pacific Coast Electrical Association—
Annual Convention—Biltmore Hotel, Los Angeles
June 8-11, 1926

National Association of Railroad and Utilities Commissioners—
Kansas City, Baltimore Hotel
Feb. 9-12, 1926

Northwest Women's Committee Has Enthusiastic Meeting

The Women's Committee of the Public Relations Section of the Northwest Electric Light and Power Association has volunteered to present one or more skits at the association convention next June as a feature of the convention entertainment. This was one of the decisions reached at the first meeting of that committee in the office of the Utah Power & Light Company, Salt Lake City, Oct. 23, 1925. Representatives from most of the member companies of the association were present, and all were enthusiastic in their willingness to take up this new activity making the women of the industry an important factor in public relations work.

Among the plans for an active year the committee decided to issue a booklet containing non-statistical information concerning the electrical industry as a whole, explaining such policies and practices as are less well understood by the layman, and as are broached frequently in the ordinary contact between employees and customers. This booklet is designed for circulation among the friends of employees as well as among those that may not have a friendly attitude toward the industry.

Considerable time at the meeting was consumed in preparing an answer to the questionnaire from the National Women's Committee intended to collect from the divisional committees their ideas on proposed activities and on the means to be employed to attain certain ends. The committee decided to hold two more meetings during the current association year, the first to be held in Seattle in February, 1926, and the time and place of the second to be set at that meeting.

The meeting was presided over by its chairman, Mrs. L. A. McArthur, Portland, and was addressed, after having been called to order, by D. C. Green, vice-president and general manager, Utah Power & Light Company.

Lighting Meeting at Riverside Opens Industrial Campaign

At a meeting held in the Riverside office of The Southern Sierras Power Company recently D. C. Pence, of the Illinois Electric Company, Los Angeles, and member of the educational committee of the Industrial Lighting Committee, Pacific Coast division, N.E.L.A., conducted an interesting and instructive discussion on the subject of industrial lighting.

Local superintendents from nearby points, together with contractor-dealers from their respective stations and from Riverside, together with the members of the commercial department sales force, were in attendance.

Merchants and Property Owners Hear Lighting Talk.—"Business Follows Light" was the subject of an address by Morris C. Hixson, sales manager of the Edison Lamp Works, San Francisco, before 75 merchants and property owners on First Street north of San Fernando, San Jose, at a meeting held at the Hotel Vendome in that city. A permanent organization is to be formed as a result of this meeting to evolve a proper lighting scheme for this district, including signs, show windows and store lighting.

Personals

H. H. Jones has been named vice-president and general manager of the Western States Gas & Electric Company, Stockton, Calif., succeeding Samuel Kahn, who recently became executive vice-president of the Market Street Railway Company, San Francisco. Although Mr. Jones for the last eighteen months has been in Minneapolis, Minn., as vice-president in charge of operations of the Northern States Power Company, he needs no introduction to the electrical fraternity of the West, for prior to his so-

H. H. JONES

journ in Minnesota he spent fourteen years as president and general manager of the San Diego Consolidated Gas & Electric Company, San Diego, Calif., a Byllesby property, as are the other companies mentioned. Before going to San Diego he served for a year as manager of the Sandpoint Division of the Northern Idaho & Mountain Power Company, now the Mountain States Power Company. Mr. Jones' early business career was associated with railroading, and he was connected at various times with the Chicago, Peoria & St. Louis Railway, the City of Reading, Pa., the Pennsylvania Railroad, the Chicago & Northwestern Railroad, and the Consolidated Railway Company of Springfield, Ill. Mr. Jones graduated from Lehigh University with the degree of civil engineer. He was born in Reading, Pa. His knowledge of the utility field and his familiarity with Western conditions make his new appointment particularly appropriate, and his many friends in the electrical industry on the Pacific Coast will be glad to welcome him back.

George Gregory, Jr., of the general merchandising department, New York, and **Howard Dye**, stores manager, Denver, Colo., both of the Western Electric Company, visited Salt Lake City not long ago.

H. A. Hammond is now the representative in the San Francisco Bay district of the Appleton Electric Company of Chicago. He has offices with Electric Agencies, Inc., at 655 Minna Street.

G. O. Hodgson, district sales manager of the Edison Lamp Works of the General Electric Company, Denver, Colo., was a visitor in Salt Lake City recently. Mr. Hodgson is one of the directors of the Lighting School to be held in Denver early in 1926. He is also one of the active members of the Electric League of Colorado.

C. E. Heise, district manager, Westinghouse Electric & Manufacturing Company, San Francisco, was the principal speaker at a recent meeting of the Oakland Electric Club. Mr. Heise outlined the history of electrical development and the part played by the late George Westinghouse in making the use of electricity practicable.

George H. Dern, governor of Utah, **George M. Bacon**, state engineer, and **W. R. Wallace**, Utah member of the Colorado River Commission, attended the recent hearing of the Federal Power Commission in Washington, D. C. Mr. Wallace and Mr. Bacon also attended the hearing before the senate committee on irrigation and reclamation at Los Angeles.

Geneva Eldredge and **Winifred Ralston**, of the publicity department of the Public Service Company of Colorado in Denver, have been awarded the prize offered by the Doherty News for the best correspondence submitted from any of the Doherty companies. To **Edward Winship**, of the gas department of the company, special credit was given for the cartoons accompanying the news items.

J. D. Nicholson, formerly Salt Lake City manager for the Mine & Smelter Supply Company, and assistant to the manager since his transfer to Denver several months ago, has been named assistant manager of the company.

Frederick Thompson, vice-president of The Pacific Electric Manufacturing Company, San Francisco, lately returned after a tour of Eastern cities. While in Chicago he opened a company office there.

Clyde H. Thayer, formerly in the commercial department of the Portland Electric Power Company, Portland, at its St. Johns office, has been promoted to be resident agent of that company in its newly acquired district at St. Helens, Ore.

Ray W. Turnbull, assistant Pacific Coast sales manager, Edison Electric Appliance Company, Portland, visited Spokane not long ago, and made a trip over the system of The Washington Water Power Company in company with **J. E. E. Royer**, assistant to the general manager, and **J. F. Farquhar**, general agent of the power company.

J. J. May will be resident manager of the display room newly opened at Pasadena, Calif., by the Empire Lighting Fixture Company of Los Angeles.

Julius Hooper, of the Rainier Electric Company, Seattle, lately returned from a visit of several weeks in the East.

M. F. Steel, Pacific Coast manager of the Benjamin Electric Manufacturing Company, with headquarters at San Francisco, was a visitor in Salt Lake City a short while ago.

C. C. Mattson, formerly electric superintendent of the Marin district of the Pacific Gas and Electric Company, San Francisco, has resigned to accept a position with the Los Angeles Gas and Electric Corporation, Los Angeles. **S. G. Olson**, of the general office of the Pacific Gas and Electric Company, has been appointed to succeed Mr. Mattson.

A. T. Slack, veteran Western Electric Company salesman, has been transferred from the Wyoming district of the company to the Denver territory. **Emil Nelson** of the Denver branch also has been assigned to the sales department in that city. **L. E. Bruce** has been named to succeed Mr. Slack in Wyoming.

Gordon Gillespie, formerly voucher clerk for the northern district of the Puget Sound Power & Light Company, at Bellingham, Wash., has been promoted to the auditing department of the company at Seattle.

W. L. Fitzpatrick, general auditor, Mountain States Power Company, Tacoma, recently made a three weeks' trip to the East on business for his company.

B. E. Rowley, Rocky Mountain district manager of the Edison Electric Appliance Company with headquarters in Salt Lake City, was a visitor at the advisory board meeting of the Electrical League of Colorado in Denver a short time ago.

G. B. Kirkwood, for several years connected with the engineering department of The Pacific Electric Manufacturing Company, San Francisco, has been placed in charge of that company's newly opened office in Chicago.

R. W. Lindley, recently sales manager of the northern district at Bellingham, Wash., for the Puget Sound Power & Light Company, Seattle, has been promoted to be manager of merchandise sales of that company with headquarters at Seattle. His childhood was spent in Illinois, but at an early age he moved to the West from Alton, settling in Lynden, Wash., in 1890. His entry into the public utility business dates from Jan. 1, 1906, when he entered the employ of a forerunner of the Puget Sound Power & Light Company in the railway department. After six months as motorman and dispatcher

R. W. LINDLEY

he became a clerk in the office and later was assigned to outside sales work. He was promoted to be sales manager at Bellingham in 1915 and held this position until his recent promotion. In his new position he heads a newly created department under H. J. Gille, sales manager. He will supervise the systematic sale of electrical merchandise throughout all the districts of the company, arranging the details of campaigns on special articles and co-ordinating the efforts of the district sales departments.

Raymond Ackerman has been appointed to represent the Benjamin Electric Manufacturing Company in Utah, Idaho and eastern Nevada. He will be located at 216 South West Temple Street, Salt Lake City.

R. E. Smith, advertising manager, Southern California Edison Company, Los Angeles, accompanied the Rotary Club of that city on its recent pilgrimage to the San Francisco Rotary Club and was one of the speakers at the joint meeting.

R. G. Chamberlain, district manager, Hurley Machine Company, Seattle, was in Spokane a short time ago on general sales matters.

C. A. Harrison, whose appointment as assistant to the general superintendent of the Public Service Company of Colorado has been announced, is a native of Colorado. He received his education in the schools of Colorado Springs and in Colorado College, from which he graduated in 1916 with honors and an A.B. degree. His predecessor in office was A. F. Morairty, who is now commercial manager of the Central Arizona Light & Power Company, Phoenix. Mr. Harrison's first practical experience was with the engineering department of the Western Union Telegraph Company. In March, 1917, he entered the Doherty Training School in Denver and three months later enlisted in the navy as an electrician. Later he was assigned to the naval academy at Annapolis where he was commissioned an ensign in the engineering division. On his discharge from the navy in 1919 he reported back to Denver and was transferred by the company to Cheyenne, Wyo., as the superintendent of the gas department of the company in that city. In 1920 he was given a similar position with the Salina Light, Power & Gas Company, now the United Power & Light

C. A. HARRISON

Corporation of Kansas, and in 1922 he was transferred back to Denver as the superintendent of gas distribution, a position which he held until his recent promotion. In his new capacity he will have charge of tax, rates, claims, personnel, transportation and other miscellaneous departments coming under the supervision of the general superintendent. Mr. Harrison has been a member of the Rocky Mountain Committee on Public Utility Information for several years and has been active also in utility association work.

J. C. Carey, Southern California Edison Company, Los Angeles, has been transferred from the general office, where he has been a distribution engineer, to the Santa Monica district of the company where he will be assistant district superintendent. Mr. Carey joined the Edison company in 1918.

F. G. Philo has been appointed superintendent of steam generation for the Southern California Edison Company, Los Angeles, replacing **R. B. Kellogg,** who has resigned. Mr. Philo joined the Edison company very recently, coming from Stone & Webster, Inc., an organization with which he had been connected for a number of years as an efficiency engineer.

Clare N. Stannard, vice-president and general manager, **John E. Loiseau,** secretary, and **V. L. Board,** general superintendent, all executives and directors of the Public Service Company of Colorado, lately attended a conference of Doherty company officials in New York City. While in the East they attended the American Gas Association convention in Atlantic City.

Berkeley H. Snow, Northwest editor of the Journal of Electricity, Portland, was in Spokane lately.

C. L. Titus, Wyoming manager for the Mountain States Telephone & Telegraph Company, and president of the Wyoming Utilities Association, and **J. A. Clay,** general manager of the Western Colorado Power Company, at Durango, Colo., attended the meeting of the Rocky Mountain Committee on Public Utility Information in Denver late in October.

R. G. Chamberlain, district manager, Hurley Machine Company, Seattle, visited Spokane lately on business.

Theo. Schou, chief engineer, The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has returned from a four-months sojourn in Europe.

H. H. Schoolfield, chief engineer, Pacific Power & Light Company, Portland, left not long ago for New York where he expects to spend about a month on business for his company.

D. I. Cone, protection engineer, Pacific Telephone & Telegraph Company, San Francisco, lately spent two weeks in Portland on matters pertaining to inductive co-ordination in the Oregon division.

F. S. Mills, vice-president, Curtis Lighting of California, Inc., Los Angeles, and **F. E. Hastings,** treasurer, recently spent some time in San Francisco discussing sales policies for 1926 with local representatives.

Harry W. Grant, superintendent of transportation for the Southwestern district of the Puget Sound Power & Light Company in Everett, Wash., since Jan. 1, 1924, has resigned to go into private business. He had been with the company since 1906. **T. F. Marsh,** former superintendent of city lines of Puget Sound Power & Light Company in Everett, has succeeded Mr. Grant.

B. J. Wildman, Pacific Coast manager, Moe-Bridges Company, with headquarters in San Francisco, left recently for a trip to Chicago and the company's factory at Milwaukee.

James Squires, division sales manager for the Pacific Gas and Electric Company at Marysville, and Frank Bevans, lighting sales engineer of the same division, attended the Illuminating Engineering Society's meeting held recently in San Francisco.

C. J. Green, since 1925 chief engineer of the Public Service Commission of Oregon, has been appointed assistant chief accountant-engineer of the Federal Power Commission, Washington, D. C. He was born in July, 1882, at Hillsdale, Mich., where he received his early education. In 1904 he went to the Michigan Agricultural College, Lansing, spending one year there in the civil engineering course. The following three years were spent at the University of Michigan, Ann Arbor, where he received the degree of B.S. in civil engineering in 1908. A year of post-graduate work in electrical engineering at this institution followed, and at a later time he completed a course in public utility accounting given by the University of Oregon, Extension Division. After some time spent in field work in irrigation and railroad construction, he entered the employ of the Mt. Hood Railway & Power Company, Portland, as commercial engineer. In June, 1911, he took a simi-

C. J. GREEN

lar position with the Portland Railway Light & Power Company, remaining until October, 1912, and January of the following year found him on the engineering staff of the Public Service Commission of Oregon. Here he was engaged principally in analyzing inventories and appraising hydroelectric properties until July, 1917, when he entered the army for war service. After sixteen months service with the 39th Artillery, C.A.C., he again returned to the Oregon commission, this time as chief engineer. His appointment to his present position with the Federal Power Commission was confirmed last November. It is expected that he will spend much of his time on the Pacific Coast in connection with administering federal regulations affecting hydroelectric properties.

Obituary

A. E. Coney, of the firm of Coney & Kuchel, electrical contractors and motor dealers of San Francisco, was killed in an automobile accident in that city on Dec. 5.

TRADE NOTES

The Major Equipment Co., Inc., Chicago, has issued Bulletin No. 5, "Major Floodlight Unit," setting forth the advantages of that unit. The illustrations are particularly attractive, color plates showing color lighting in theaters, exterior floodlighting, spotlighting in show windows and industrial floodlighting as in railroad yards. The booklet emphasizes the construction, adaptability, reflecting power and method of the focusing unit for which the highest floodlighting efficiency is claimed. List prices and dimensions are given. The Major Equipment Company is represented in San Francisco, Los Angeles, Portland and Seattle by the **H. B. Squires Company.**

Holzwasser, Inc., located at Fifth and Broadway, San Diego, has been appointed agent for the Electro-Kold Corporation and will handle this refrigerator line exclusively in San Diego. The department will be in charge of C. H. Robbins.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, describes carbon circuit breakers for industrial installations in its circular No. 1705-A. A new automatic changeover switch, type M, is described in leaflet No. 20234 just issued by the company.

Elwell-Parker Electric Company, Cleveland, has developed a new type of portable battery-driven furnace charger which it is claimed is both a time and labor-saver as well as an economizer of furnace heat.

Ward Electric Company, Mount Vernon, N. Y., has issued bulletin 69 on Vitrohm battery-charging equipment. It contains a complete price list.

Uehling Instrument Company, Paterson, N. J., has perfected recently a recording instrument known as the waste meter. With its aid the fuel wasted readily may be determined either in dollars and cents, in B.t.u. or in per cent of the fuel burned during any time interval.

The O. C. White Company, Worcester, Mass., has issued catalog No. 26 which contains a complete description of the White adjustable electric light fixtures in applied illumination.

Hayes Electric Service recently has been opened by P. Z. Hayes at 711 E. Mariposa Street, Altadena, Calif. Mr. Hayes will specialize on wiring, he having recently completed wiring two hundred and fifty homes built in Altadena by the E. P. Janes Company.

John F. Winn, formerly operating an electric store at 30 North Greenwood Avenue, Pasadena, has opened a new store at 1936 E. Colorado Boulevard and is specializing on lighting fixtures.

E. W. Taylor has opened a new store at 829 E. Colorado Boulevard, Pasadena, where he is specializing on sales of Zenith washers and Eureka cleaners. Mr. Taylor was formerly sales manager of the Home Appliance Company, also "Schleuters" Maytag Store in Pasadena.

The Appleton Electric Company, Chicago, has opened a Seattle branch office at 420 Polson Building, with C. H. Shoemaker, the firm's representative in Seattle for four years, in charge. The branch carries a complete factory stock of outlet boxes, covers, switch boxes, locknuts, bushings, service fittings and complete Unilet fitting line.

Electric Supply Company, Oakland, Calif., recently has opened another supply house in San Francisco, where it will handle a full line of radio sets, radio parts and electrical specialties. The concern is located at 1063 Howard Street.

The Brown Instrument Company, Philadelphia, has opened new offices at 215 East New York Street, Indianapolis, in charge of J. E. Green, and at 1108 Hippodrome Building, Cleveland, in charge of G. S. Frazee.

The F. W. Wakefield Brass Company, Vermilion, Ohio, has developed a new and attractive form of portable bracket which it claims "attaches anywhere, any way." It is known as the "Attachette."

The Reliable Electric Company after having been in business for three years without a retail store location, has equipped one at 1303 Broadway in Denver. Morris R. Price is the proprietor.

The John Hancock Electrical Company has closed its retail display room at 1420 Sixteenth Street in Denver and has arranged a lighting-fixuture display at the factory, 1412 Wazee Street. Metal objects of art and silver plating have been added to the line of the Hancock company.

The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has opened a new district office in Lima, Peru, in charge of W. G. Bolton. This office, as well as the one at Oruro, Bolivia, is a branch of the company's office at Santiago, Chile, of which W. R. Judson is manager. The Oruro office is in charge of P. G. Gilliard, succeeding Erling Winsnes, who has returned to the United States.

Electro-Kold Corporation, Spokane, Wash., has appointed the **McNally Company,** 101 W. Colorado Street, Pasadena, Calif., to handle its product in that city.

Chicago Fuse Manufacturing Company, Chicago, has issued a convenient motor-rating card for posting in industrial plants where electric motors are used. Besides giving the full-load current, the correct ratings of starting fuses and running fuses for properly protecting different types and sizes of motors are indicated.

The Okonite Company, Passaic, N. J., has issued a new illustrated booklet containing data on splices and tapes for rubber-insulated wires. The importance of a perfect splice, the important properties of tape, how to recognize these properties, and how to make a perfect splice are the subjects covered in the booklet.

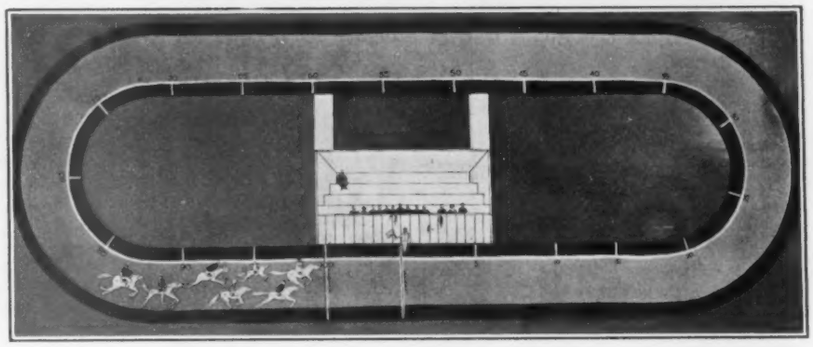
Magnetic Signal Company, Los Angeles, has issued catalog C, giving a complete description, with photographs and drawings, of its magnetic wigwag crossing flagman with signal accessories and supplies.

The Wagner Electric Corporation, 538 First Avenue South, Seattle, will move on Jan. 1 to new quarters at 1919 First Avenue South where it will have 2,000 additional square feet of floor space in a new two-story concrete building. M. E. Cundall is Northwest district manager.

The Kuhlman Electric Company, Bay City, Mich., has awarded a contract to the Henry G. Webber Construction Company for an addition to the Kuhlman factory. The new addition will cover an area of 75 x 250 ft.

Automatic Electric Washer Company, Newton, Iowa, has announced a new model, known as No. 264. The manufacturer claims the most noticeable improvement in this new model is its attractive olive green cabinet, completely enclosing all mechanism below the tub. No. 264 also has a new type wringer and the cabinet is finished in "Duco". The highly polished copper tub, tinned inside, which is easy to keep clean and drains itself, is also one of the attractive features of this new washer.

Power Plant Specialty Company, Chicago, has issued bulletin 110, which contains data on water for boiler-feed use under conditions of high pressures and overloads.



Tijuana racing reason opening? Not at all. Merely a novel method of stimulating interest among the sales people in its Salt Lake division was this miniature race track installed by the Utah Power & Light Company in the basement of its Salt Lake store. The course was marked by numbers, representing per cent of quota on range sales, and each salesman was shown mounted on a flying steed. Each rider moved nearer the 100 per cent figure (shown at the finish) in accordance with the number of range sales he made each day. The interest in the race was not confined entirely to the sales force, as was evidenced by the fact that a number of employees of other departments followed the contest each day to determine the positions of the riders.

ANNOUNCEMENT

Copeland Products, Inc., Detroit

Manufacturers of

Copeland Refrigerating Systems

ORGANIZATION

Headed by Wm. Robt. Wilson, President, who as personal assistant to the Dodge Brothers, Vice-President of the Irving National Bank of New York and President of Maxwell Motors Corp. has been recognized as an executive and leader of outstanding ability.

ITS PRODUCT

Developed by E. J. Copeland, whose pioneer work in the field of electric refrigeration dates from 1914 and whose successful experience as President and General Manager of the Kelvinator Corporation provided the background of knowledge and sound judgment for the new and important engineering development which bears his name as its trade-mark.

ITS POLICIES

Conceived by men who know the value of good-will and the sacrifices that must be made to win and hold it—who understand the wants and viewpoint of the buying public—who appreciate the needs and problems of the trade and recognize the costs and hazards of distribution and service work.

DIRECTORATE

Composed of nine men of high standing in the industrial and commercial affairs of Michigan—who are accustomed to large-scale operations planned and executed along broad, constructive lines—and whose combined personal resources are in excess of $50,000,000.

WM. ROBT. WILSON, President

For several years, personal assistant to John Dodge and Horace Dodge at the time when Dodge Brothers were establishing the foundation for their great success; then, Vice-President of the Irving National Bank of New York; subsequently, President and General Manager of the Maxwell Motors Corporation during 1921, 1922 and 1923 when that organization moved from 23rd place to 7th place in the motor industry.

E. S. BARBER, Vice-President
General Sales Manager

He comes to Copeland with a remarkable experience in various fields of selling. Five years' marketing experience with the Chicago Tribune. For six years, general sales manager of Society Brand Clothes; for two years a Director of that company. Later a member of the United States Rubber Company, Executive Staff on marketing.

D. S. FARLEY,
Field Sales Manager

Attended Engineering Dept., University of Michigan, 1913–1916. Was engaged in the manufacture and selling of special tools, fixtures and equipment for such concerns as the Buick Motor Company, A. C. Spark Plug Company, Flint Motor Company. Member of the Copeland organization from the start. Experienced in sales, service and production.

A YARDSTICK FOR MEASURING

M. B. ELLS,
Service Manager

Engineering training, Miami University. Held following positions with the Frigidaire Corporation: (1) Foreman, Final Testing Dept., (2) Asst. Service Manager, (3) District Manager. Subsequently acted as Asst. Sales Manager for Green Engineering Co., and in same capacity for Vacuum Oil Co.; later as Sales Mgr. of the Even Heat Oil Burner Co.

A. D. KELLEY,
Asst. Sales Manager

Mechanical engineering course, Notre Dame University. Shop and sales work, cash registers. Sales work in field and at factory in truck and automobile business including Dodge Brothers and special work for General Motors. Then New York Manager of the Kelvinator Corporation in charge of sales and service.

Electric refrigeration—a new industry at the beginning of a new era—is now entering a period of great commercial expansion.

Today men throughout the country are studying the situation, analyzing the profit opportunities in this field. The man who makes the right factory connection at this time will, in the next year or two, lay the foundation for large sales volume and high earning power. He will be in the same relative position as the man who obtained the Dodge Brothers franchise back in 1914.

To you who are pondering the question we offer this simple yardstick on which to base your decision:

(1) Is the management sound and progressive?
(2) Is it in a strong financial position?
(3) Is the system itself highly dependable?
(4) Does the service plan operate efficiently?

To occupy a dominant position, to afford the men who market its product the opportunity they want, the factory must build on this four-square basis.

With such facts before you, you can correctly appraise the value of the Copeland franchise. Full details on request.

E. H. BROWN, Vice-President

Sales engineer and executive, Aluminum Company of America, 1904–1912. Co-organizer of General Aluminum & Brass Mfg. Co., also Vice-President and Treasurer; this concern in 10 years became the largest manufacturer of high-grade bearings in the world.

FRED F. BRUECKNER, Production Manager

Eighteen years in designing machinery for Singer Sewing Machine Company. With Studebaker and Dodge Brothers as chief tool designer. Designed boring machine for making recoil mechanisms. Advisor to U. S. Ordnance and Aircraft Depts. Designed war machines for Bethlehem Steel Co. Production expert for General Motors and Engineer of Production for Maxwell-Chrysler.

E. J. COPELAND, Vice-President

With the Buick Motor Company as a primary executive in 1913. Founder President and General Manager of the Kelvinator Corporation. Over a period of years he conducted more than 1000 engineering tests in the process of developing the Kelvinator System, at a cost in excess of $511,000. In perfecting the Copeland System, he carried out 143 additional tests at a cost of $273,000.

YOUR NEW PROFIT OPPORTUNITY

Here you see the men who are managing this business. Note particularly how the organization is balanced. Apart from the ability of these men as individuals, the organization as a whole has a very definite and unusual personality—*a certain spirit of progressive cooperation which you will sense when you make the acquaintance of these men.*

On page four of this announcement are the names of the Directors with a statement of their industrial and financial affiliations—a forward-looking group with total personal resources of more than $50,000,000.

The directors and executives are unanimous in the belief that what they are marketing is a service, not merely a product. SERVICE, in the fullest sense of the word, is the idea behind all their operations. In fact, the organization was conceived and built from that point of view.

The product itself is the final development of 11 years of experience. E. J. Copeland is generally recognized as the pioneer in this field. In developing Kelvinator and Copeland he carried out more than 1143 engineering tests at a cost of $784,000.

MANUAL LASSEN, Chief Engineer

Graduate M. E. Acted as Maintenance Engineer for two great European plants and for 5 years as Engineer for Continental Motors. Then Asst. Chief Engineer for Frigidaire, 3½ years. Designer and co-patentee of Nizer Commercial Refrigerating System. Consulting Refrigeration Engineer, 2½ years. Inventor of automatic control for ice machines.

F. J. CORNEIL, Experimental Engineer

1911 to 1916, Chief Chemist, American Boston Mine of M. A. Hanna & Co. Research work with Aetna Explosive Co. Five years with A. C. Spark Plug Co., engaged in research work directly responsible to Mr. Champion. Operated the primary distillation department of Ford Motor Co. at Iron Mountain, Michigan.

BOARD OF DIRECTORS

EDWIN W. ATWOOD
Director Genesee County Savings Bank and Director First National Bank, Flint, Michigan.

FRANK D. BUCKINGHAM
Director Citizens Commercial and Savings Bank, Flint, Michigan.

EDWIN H. BROWN
Vice-President Copeland Products, Inc.; formerly Vice-President General Aluminum & Brass Mfg. Co., Detroit; Director Bohn Aluminum & Brass Corpn., Detroit.

HENRY T. COLE
President United States Radiator Corporation.

MERLIN WILEY
Member of the law firm of MacKay, Wiley, Streeter & Tucker, Detroit.

E. J. COPELAND
Vice-President, Copeland Products, Inc., formerly President and General Manager Kelvinator Corporation.

PAUL H. DEMING
Banker and capitalist; director of a number of large industrial organizations in Michigan.

FRED T. MURPHY
Director Peoples State Bank, Detroit; Trustee Murphy Family Trust, Detroit; also director of several commercial and industrial institutions.

WM. ROBT. WILSON
President Copeland Products, Inc.; also President Guardian Trust Company, Detroit and Director Bank of Detroit; formerly President Maxwell Motors Corpn.

The Copeland Franchise a Business Asset

The great future of electric refrigeration in the home is now an established fact. No one who has given the subject any study questions the great opportunity which lies before this industry. The history of automobiles, washing machines and vacuum cleaners, in fact the record of any industry — shows that those who profit most are the men who first obtain a franchise from the right factory organization and grow with the rising wave of public interest. That the Copeland Franchise is a business asset which offers an able man or marketing organization great earning power is clearly indicated by the facts outlined in this announcement.

"We are only interested in selling our systems in conjunction with service to purchasers and have evolved a new and definite plan of action and co-operation wherein success and profit to the dealer representing us is the backbone of our idea."

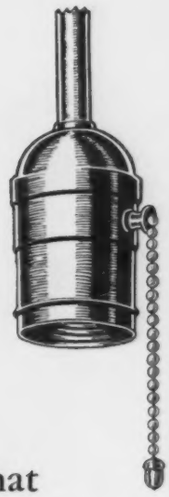
EARLE S. BARBER
Genl. Sales Mgr.

We suggest that you write without delay for our complete Franchise Plan, giving in your letter full details as to the past record and present activities of your organization. It may be advisable for you to visit Detroit and see our officials at the factory where interchange of information can be completed in one meeting.

COPELAND PRODUCTS, Inc., DETROIT

SERVEL
ICE BY WIRE

Speaking of Dividends...



WHAT ABOUT that ONE OUTLET in each home on your lines representing ONE HALF the potential revenue from each domestic consumer?

That outlet is waiting for SERVEL! Functioning in one-third the homes of your consumers it will probably double your Net Earnings

..... and net earnings mean dividends!

A Servel

© 1925 T. S. C., New York

Typical of American Progress

A FAR cry from the days of our forefathers of the 17th Century to the American Home of 1925!

The gentle mistress of the simple Puritan Home little dreamed of the many domestic blessings for which her sister of today gives thanks!

The myriad electrical conveniences, comforts, luxuries, economies—the labor-saving, health-protecting appliances in the modern household—how different from the methods of that home of long ago!

It is quite in order that the delicious viands which grace the table on *this* Thanksgiving Day should be kept fresh and sweet and wholesome—by means of "Servel" Ideal Electric Refrigeration.

To Our Lady of Bygone Days many of the salads, foods and frozen dainties now served would cause wonderment indeed, for they are products of the new *electric cold cuisine* made possible by "Servel."

Yes! On this and every Thanksgiving Day in the years to come—"Servel" will play an important part in the Annual Feast of the American Nation.

SERVEL may be purchased on the deferred payment plan.

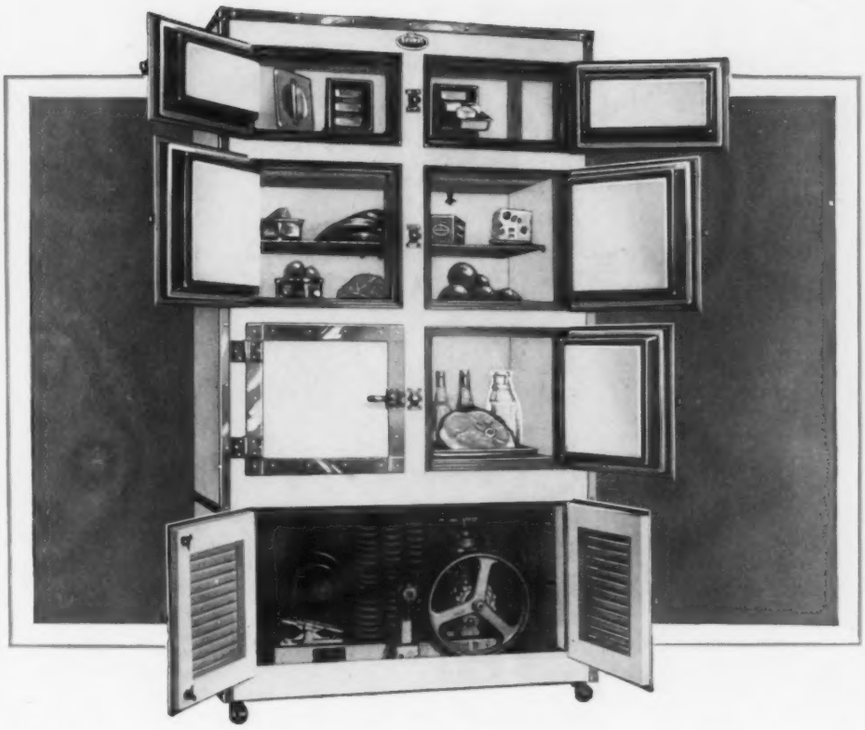
Your Electric Service Company will direct you to your nearest SERVEL Dealer.

SERVEL
ICE BY WIRE

Our trade marks registered in U. S. and applications for registration pending the world over

This is *one* of the many ways in which
to the value of SERVEL

Thanksgiving



What SERVEL *Contributes to the Home*

¶ Genuine Refrigeration—Maintaining without variation predetermined temperatures, so low that the development of bacteria and resulting decay are *prevented*—not merely *retarded* somewhat—as with the ordinary ice "cooled" refrigerator.

¶ Dry Cold—so necessary to the proper preservation of foodstuffs, because SERVEL removes moisture from the air instead of increasing the humidity as does melting ice.

¶ All perishable food kept perfectly fresh, retaining its flavor without deterioration, thus effecting great economy.

¶ Odors or objectionable flavors are not transmitted from one food to another.

¶ Vegetables remain fresh and crisp, retaining their flavor for days.

¶ Fresh milk will keep sweet for periods as long as two weeks.

¶ Meats retain their flavor and do not become tainted.

¶ Ice cubes are manufactured automatically from *water of your own selection.*

¶ Eliminates the necessity of emptying drain pans or cleaning out the accumulation of slime and filth, resulting from melting ice.

¶ Eliminates food spoilage by maintaining a *constant* preserving temperature.

¶ Assures independence of the ice-man—irregular ice deliveries—the necessity of remaining at home to receive him.

¶ Makes it possible to leave food in the refrigerator while away on holiday trips because there is no ice to melt away—electricity maintaining the same unvarying temperature and dry, crisp atmosphere day and night—summer and winter—without attention from anyone.

¶ The refrigerator may be located in or immediately adjacent to the kitchen—accessible and convenient at all times.

¶ Costs less than ice—only when your ice bill is registered on that accurate automatic accounting device—the electric meter—will you know positively that you are paying for just the refrigeration you actually have secured.

Refrigerators with built-in Servel, ready to operate from any electric light socket, are priced at $295 and up—f. o. b. factory

Your own refrigerator may also be SERVEL equipped at very reasonable cost

THE SERVEL CORPORATION · NEW YORK

CHICAGO LOS ANGELES

FACTORIES: EVANSVILLE, INDIANA CARTERET, NEW JERSEY NEWBURGH, NEW YORK

ich e are educating the American Public
EL deal Electric Refrigeration.

One of the many models for domestic and commercial use

Remember!

"SERVEL" increases revenue—profits—dividends by delivering 85% non-peak load—with no additional investment in line equipment, meters, or special apparatus.

Overhead remains practically the same—production costs are but *slightly* increased—the greater part of each dollar thus earned is NET PROFIT.

We are dedicated to the Electric Service Company and its interests.

Our policies and plans are conceived in your interest and we are prepared to do our part to

Double your revenue and increase your dividends

THE SERVEL CORPORATION

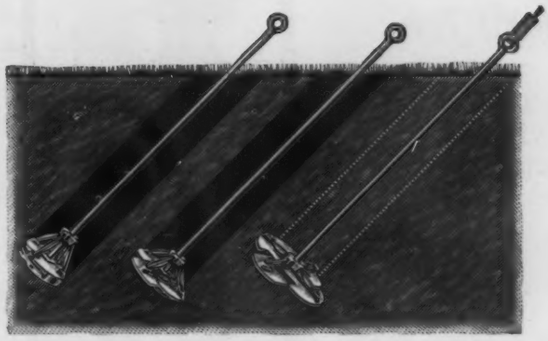
CHICAGO **NEW YORK** LOS ANGELES

Factories: EVANSVILLE, IND. CARTERET, N. J. NEWBURGH, N. Y.

© 1925 T. S. C., New York

F 1002

EVERSTICK
ANCHORS



Closed

Permanent Installations

Guy wire installations are permanent when Everstick Anchors are used. The use of the Everstick Installing Bar insures complete expansion of the blades at right angles to the Guy rod. The entire circumference of the anchor plate then has a permanent grip in solid earth. They are easily and quickly installed. You can bury your Guy wire troubles with Everstick Anchors.

Closed

Fully Expanded
TWO-WAY

Fully Expanded
FOUR-WAY

MANUFACTURED BY

THE EVERSTICK ANCHOR COMPANY

ST. LOUIS, MISSOURI

Pacific Coast Stocks Carried by

BAKER-JOSLYN COMPANY

DISTRIBUTERS

ELECTRICAL EQUIPMENT AND CONSTRUCTION MATERIALS

SEATTLE PORTLAND SAN FRANCISCO LOS ANGELES

Hubbard Hardware

There is a Peirce Rack for Every Secondary Job

When secondaries are tied to Peirce Racks uninterrupted service is assured. All Peirce Racks are made from new rolled open hearth steel and are designed so that the point of fastening is in direct line with the strain, thus developing the full strength of the metal used.

They are made in six types; Standard type, Extended Back type, Light Presteel type, Heavy Presteel type, Horizontal type and Huff type.

These Racks are supporting dead end loads of 500,000 C.M. weather-proof cables on spans of 100 feet and are carrying cables as large as 1,000,000 C.M. on spans up to 150 feet in length without a single rack having failed in service.

These Racks are described complete in Bulletin No. 3. (Write for it today.)

Sold exclusively and carried in stock by the leading electrical jobbers.

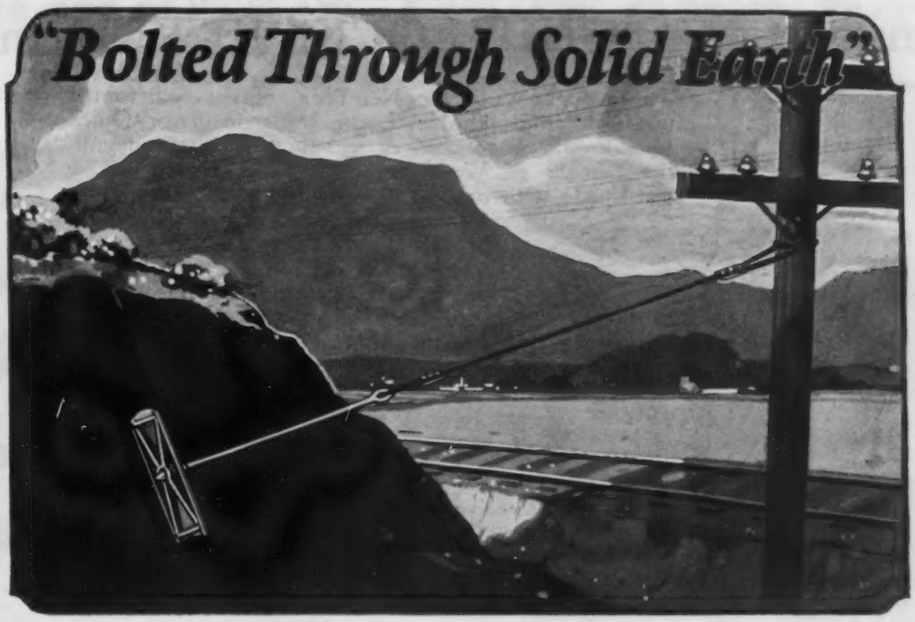
for uninterrupted service

PEIRCE
Secondary Racks

HUBBARD & COMPANY
Pittsburgh Chicago Oakland

PACIFIC STATES
ELECTRIC COMPANY

Distributors for Identifies Quality Electrical Merchandise and Reliable Contractors and Merchants — Check Seal — PACIFIC STATES ELECTRIC COMPANY *the Pacific Coast*



When You Figure Costs You Will Use a Never-Creep

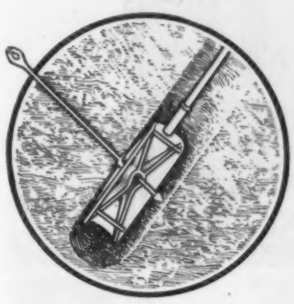
When conditions were particularly favorable Chance Never-Creep Anchors have been installed in seven minutes. The average time required for a large number of installations, however, was twenty-five minutes. Based on this time, the average labor cost for installing a Never-Creep Anchor is 70c.

Compare this with the cost of digging a pit for a wooden deadman or digging large holes required for other anchors. Such a comparison must prove to you that the cost of installing Never-Creep Anchors is much less than any other anchor on the market.

Manufactured by

CHANCE COMPANY

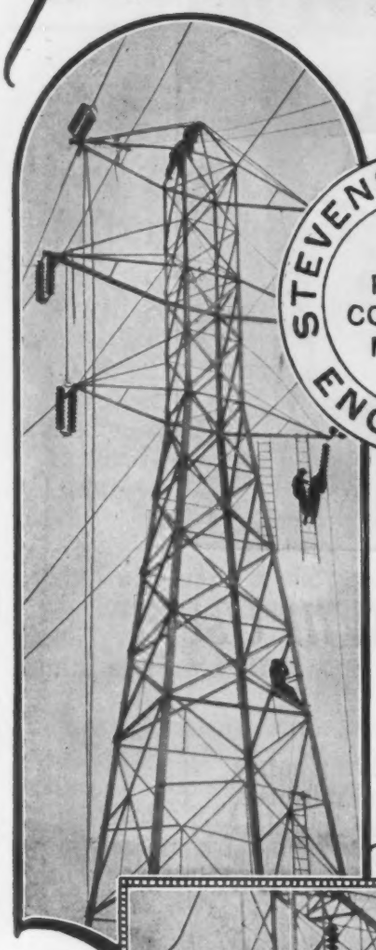
CENTRALIA, MO.



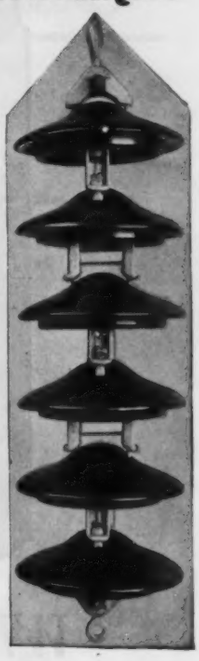
PACIFIC STATES ELECTRIC COMPANY

Pacific Coast Sales Agents

The Ohio River Edison Company completes the First installation of the NEW LOCKE HEWLETT insulators



To Stevens & Wood, Inc., New York, goes the credit for the first installation of the New Locke Hewlett insulators. Quick to realize the importance of so valuable a development, the Stevens & Wood engineers ordered comparative tests made with other types. Every known method for determining ultimate performance under operating conditions was employed under the direction of research engineers in the foremost electrical laboratory of the country. The electrical and mechanical characteristics far exceeded the values ever before developed in a Hewlett insulator, and the decision was made to install the New Locke Hewletts on the new line of the Ohio River Edison Company, then under construction.



This is a 132,000-volt line, forty miles in length, extending from the generating station at Toronto, Ohio, to the Boardman Substation four miles south of Youngstown. At this point the energy is stepped down to 66,000 volts and is connected with the properties of the Pennsylvania-Ohio Power and Light Company, the Pennsylvania-Ohio Electric Company, the Shenango Valley Electric Company and other subsidiaries of the Republic Railway and Light group.

The New Locke Hewletts are also employed in suspension at Toronto and Boardman for all main busses and taps. This line is now in operation, and operating companies are referred to Stevens & Wood for information covering the results so far obtained.

LINE DATA

196 steel towers—span length, 1070 feet.

Towers, 75 feet high at lower cross arm with 10-foot and 20-foot extensions as needed. Vertical spacing between cross arms, 13 feet.

Top and bottom cross arms, 23 feet 9 inches long. Middle cross arm, 28 feet 9 inches long —giving a 2½-foot offset to prevent insulator strings touching under heavy sleet conditions.

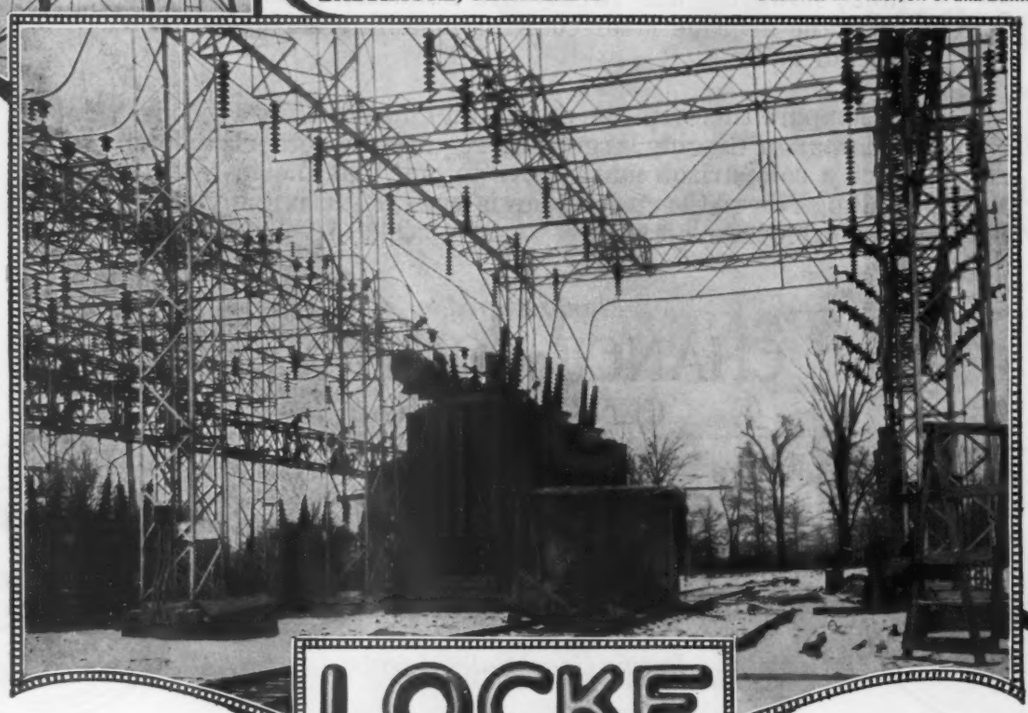
Size of cable 300,000 circ-mils, 19-strand copper.

Locke units used in suspension, 9; Locke units used in strain position, 10.

LOCKE INSULATOR CORPORATION

BALTIMORE, MARYLAND

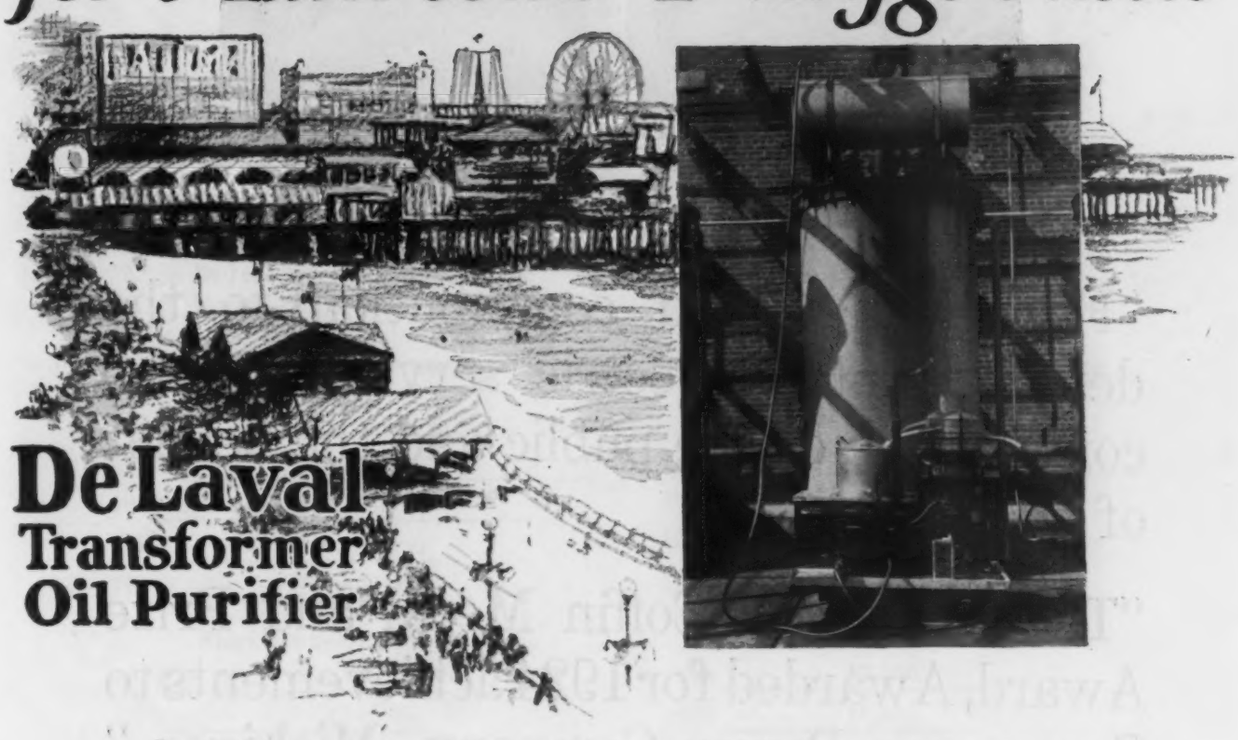
Factories at Victor, N. Y. and Baltimore, Md.



LOCKE

PORCELAIN

Dependable light and power for America's Playground



De Laval Transformer Oil Purifier

IN so far as clean, dry transformer oil and switch oil can insure dependable light and power service Atlantic City is safe, for the Atlantic City Electric Company, which does practically the entire lighting and power business for that world-famous playground, maintains the dielectric strength of its oil at all times with the portable De Laval Transformer Oil Purifier shown above. This machine is also frequently used to give the turbine lubricating oil a thorough cleaning.

De Laval centrifugal purification is the most positive oil conditioning method known. It adds to ordinary centrifugal purification the tremendous advantage of the patented De Laval system of strata distribution, by means of which the oil is divided into thin sheets or layers so that impurities are more easily removed.

Thus by virtue of the disc construction of its bowl, the De Laval Oil Purifier is enabled to consistently effect a more complete and uniform purification of oil than can be accomplished by any other method.

That is why De Laval Oil Purifiers are used by 80% of the largest electric power systems in America.

The De Laval engineering department will be glad to cooperate with you in order that your transformer oil, switch oil and lubricating oil may give the same kind of service that keeps these great systems and hundreds of smaller ones running so smoothly. We have interesting proof of the savings in machinery, oil and labor that can be made. Mail the coupon for further information.

The De Laval Separator Company

New York, 165 Broadway Chicago, 600 Jackson Blvd.

DE LAVAL PACIFIC COMPANY
61 Beale St., San Francisco

Sooner or later you will use a

De Laval

Please send Bulletin containing further information regarding the De Laval Oil Purifier as checked below:

- ☐ Purification of turbine lubricating oil.
- ☐ Purification of Diesel lubricating and fuel oil.
- ☐ Dehydration of transformer oil.

Name .....

Company .....

J. E. 529T

Address .....

CHARLES A. COFFIN MEDAL
FOR DISTINGUISHED CONTRIBUTION TO THE DEVELOPMENT OF ELECTRIC LIGHT AND POWER FOR THE CONVENIENCE OF THE PUBLIC AND THE BENEFIT OF THE INDUSTRY
AWARDED TO
PRESENTED TO THE CONSUMERS POWER COMPANY, MICHIGAN

"For distinguished contribution to the development of electric service for the convenience of the public and the benefit of the industry."

"The Charles A. Coffin Medal and Prize Award, Awarded for 1924 achievements to Consumers Power Company, Michigan."

Notable among 1924 achievements are:

Further development and perfection of state-wide 140,000-volt Superpower system —radio dispatching—and integral generating resources.

Extension of interconnected electric facilities to small communities—re-building distribution to standard—adjusting of rates—and opening new development possibilities to such towns.

Adoption of uniform rate schedules in all communities as policy of Superpower service.

General reduction of residence rates to pre-war levels in majority of cases.

Construction of experimental farm electric lines in cooperation with state agricultural authorities.

Inauguration of greatest conservation program ever undertaken in Michigan—affecting forests, fish and game.

Attaining ratio of one customer-stockholder to each nine homes served.

Consistent advertising and public relations program formulated and effectuated.

CONSUMERS

General Offices

1924
Makes New Progress Records
in
"Good Service to Michigan"

174 Michigan Cities and Towns Served
5.2% Increase in Population
14.1% Increase in Lighting Sales per capita
87% of Homes in territory Electrified
1 in each 9 Homes served represents Stockholder

129,300 K.W. Steam Generating Capacity
120,400 K.W. Hydro Generating Capacity on completion present program
96% modern, efficient type units
1.81 lbs. coal per K.W.H.—1924 average

Kilowatt Hours Sold

1924	459,781,000
1923	443,163,000
1922	346,150,000
1921	294,409,000

Customers—(Electric)

1924	201,904
1923	180,785
1922	149,124
1921	130,421

Stock Owned by Customers

1924	$15,988,100.00
1923	9,315,000.00
1922	4,267,600.00
1921	2,006,200.00

Customer-Stockholders

1924	17,966
1923	11,578
1922	5,766
1921	3,613

Gross Earnings

1924	$18,328,150.00
1923	16,877,422.00
1922	14,201,202.00
1921	13,174,207.00

GAS SERVICE: 94,200 customers in 15 communities
2,854,190,000 cu. ft. 1924 sales
25,210,000 cu. ft. daily production capacity

POWER

Jackson, Michigan

A Record Breaker

"Get in touch with Condit"

Just as Nurmi, the record breaker, stands as the supreme example of physical prowess—so does the CONDIT F-9 stand pre-eminent in its field, with construction features proved by the test of service.

All steel construction. Double tanks — with energy absorption principle. Four breaks—high speed of circuit interruption.

CONDIT ELECTRICAL MFG. CO.
Manufacturers of Electrical Protective Devices
South Boston, Mass.
Represented by The H. B. Squires Co. in Seattle, San Francisco and Los Angeles

8153

Specifications: *Platen or truck type. Standard capacities, 15,000 or 25,000 volts; interrupting capacity 30,000 amperes at 15,000 volts.*

CONDIT

OKONITE-CALLENDER

SUPER-TENSION CABLES

OKONITE PRODUCTS

OKONITE INSULATED WIRES & CABLES

VARNISHED CAMBRIC CABLES

OKONITE INSULATING TAPE

MANSON & DUNDEE FRICTION TAPES

OKONITE CEMENT

OKOCORD

OKOLOOM

OKONITE-CALLENDER PRODUCTS

PAPER INSULATED CABLES

SUPER-TENSION CABLES

SPLICING MATERIALS

BEGINNING super-tension cable production in 1915, Callender's Cable & Construction Co. Ltd. of London, England, has manufactured over two million (2,000,000) feet of Three Conductor Impregnated Paper Cables for voltages from 33,000 to 55,000 all of which have been successfully operating at their rated voltage since installation.

These cables are installed in duct systems as well as buried directly in the ground, and are scattered all over the world under all climatic conditions. *We challenge attention to this record.*

Callender Process Paper Cables are not an experiment; for the lower voltages they have proved themselves since 1890, and for voltages of 33,000 and over since 1915.

Okonite-Callender Paper Cables will be made by the same process, with the same machinery and under the supervision of Callender trained men.

Tell us your cable problems and let our Electrical Research Laboratory and our Engineering Department assist you in solving them. *We freely offer you our facilities and solicit your inquiries.*

Callender 55,000 Volt Cable, now operating

The Okonite Company
The Okonite-Callender Cable Company, Inc.

Factories, PASSAIC, N. J. PATERSON, N. J.

Sales Offices: New York · Chicago · Pittsburgh · St. Louis
Atlanta · Birmingham · San Francisco · Los Angeles

F. D. Lawrence Electric Co., Cincinnati, O.
Novelty Electric Co., Phila., Pa. Pettingell-Andrews Co., Boston, Mass.
Canadian Representatives: Engineering Materials Limited, Montreal

OKONITE

OKONITE-CALLENDER

Announcing

A NEW 25 watt National MAZDA Lamp, combining the principal advantages of the various other types now in existence and including recent developments not obtained in these other types, is here announced to the electrical trade.

This new 25 watt National MAZDA Lamp is intended primarily for residence service. It can readily replace four other 25 watt lamps now in use — the straight side, the mill type and the two round lamps. This greatly simplifies the lamp agent's stock.

The outstanding development is a bulb of pleasing design **frosted** on the inside. The outside is perfectly smooth, making the lamp easy to keep clean.

Due to the inside frost, the new lamp is far superior to the clear lamp in light diffusion and yet it absorbs but little more light than does the clear lamp.

The new lamp is very strong and much more rugged than previous lamps for comparable uses.

Additional lamps of this type will probably be introduced at a later date. It is hoped that, in time, the present large assortment of lamps of 100 watts and smaller, as used in residence service, can be replaced by about five lamps similar to this new type.

a new MAZDA lamp

NATIONAL

MAZDA LAMPS

A GENERAL ELECTRIC PRODUCT

X-Ray TRADE MARK REG. Again!

Here's two pair that are *Brand New!*

—At popular prices!
—And the holders—FREE!
—Regular X-Ray Discounts apply!

Twenty-nine years in the business, always ahead, that's X-Ray!

CURTIS LIGHTING, INC.
(Makers of X-Ray Reflectors)
1109 West Jackson Boulevard
CHICAGO, ILLINOIS
31 W. 46th St., New York 3113 W. Sixth St., Los Angeles

"JACK" No. 400
and
"JILL" No. 410
for 150 Watt Lamps
LIST PRICE..... $4.50

"KING" No. 500
and
"QUEEN" No. 510
for 200 Watt Lamps
LIST PRICE..... $6.00

[With Each Reflector a Universal Holder to Fit Any Socket FREE!]

Emerson Jr.

"Awfully Good but doesn't cost much"

EMERSON Junior is the popular-priced sales leader of the Emerson Line of fans. A nine-inch non-oscillator, with Emerson quality all the way through, and carrying the Emerson 5-year guarantee. Convenient switch in base. Just the fan that a great big part of the public wants.

The Emerson is a complete fan line including every type and size in demand. Small fans, large fans; oscillators, non-oscillators, 9-inch, 12-inch, 16-inch sizes; special quiet residence types in harmonious finish; ceiling fans with 32-inch or 56-inch sweep; ventilating fans.

EMERSON FANS with the 5 year guarantee

Emerson Fans are carried in stock by these Pacific Coast Distributors:

LOS ANGELES, CALIF.
California Hardware Company
Woodill and Hulse Electric Co.

SAN FRANCISCO, CALIF.
Baker, Hamilton and Pacific Co.
Electric Appliance Company

PORTLAND, ORE.
Marshall-Wells Company

SPOKANE, WASH.
Marshall-Wells Company

SAN DIEGO, CALIF.
Electric Supplies Distributing Co.

Order Emerson fans from these distributors.

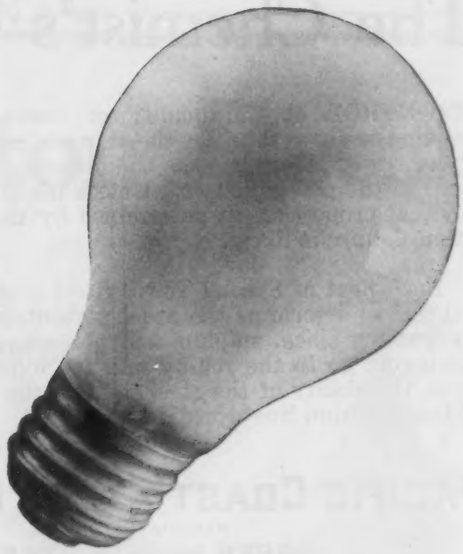
The Emerson Electric Mfg. Co.

2018 Washington Avenue

50 Church St.,
New York City

St. Louis, Mo.

This is the new



25-watt Edison MAZDA Lamp

on which production has been started and which will shortly be available for distribution in limited quantities.

The new lamp will combine all the outstanding advantages of the other types now in use and will incorporate recent developments not to be found in any other type.

It is not, therefore, an extra type to be added to the list of 25-watt lamps now on Agents' shelves. It is designed to replace the other 25-watt lamps —the straight side, the mill type and the two round lamps.

So this new lamp is of double importance to the Edison MAZDA Lamp Agent since it will mean a great simplification of his lamp stock and a corresponding simplification of records.

The lamp is of graceful design and is frosted on the inside. The outside is perfectly smooth and as easily cleaned as a clear lamp. Yet the diffusion of light from this new lamp is greatly superior to that of the clear lamp, and the loss of light due to the frosting is negligible.

This is only the beginning. It is expected that soon only five lamps will be needed to fill the majority of residence lighting requirements.

EDISON MAZDA LAMPS

A GENERAL ELECTRIC PRODUCT

The Chemist's Okeh on Tower Steel

CONTROL of the quality of tower steel by chemical analysis is as vital for the safe and continuous operation of transmission lines as the metering and control equipment in the power houses. Unless the steel has the proper physical properties, as determined by the chemical composition, failure is likely.

Each heat of Special Tower Steel is given a rigid chemical test to determine the exact percentages of iron, carbon, manganese, silica, sulphur and phosphorous. Thus when the ingots go to the rolling mill for rolling into tower sections, the ability of the steel to meet the exacting demands of transmission line work is established.

PACIFIC COAST STEEL COMPANY

MANUFACTURERS OF

OPEN HEARTH STEEL

STRUCTURAL SHAPES MERCHANT AND REINFORCING BARS

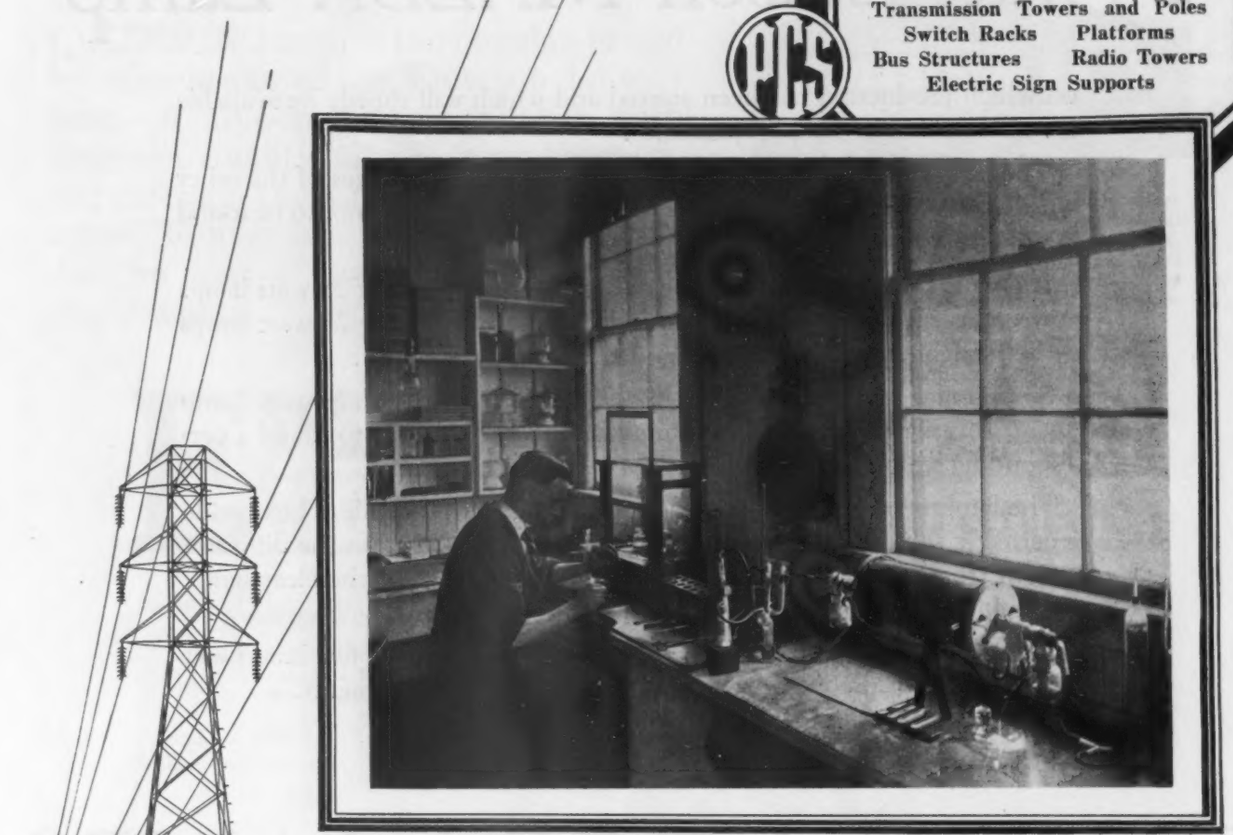
TRANSMISSION TOWERS AND STRUCTURES

Gen'l Office: Rialto Bldg., San Francisco Plants: San Francisco, Portland, Seattle

SPECIAL TOWER STEEL

is the tough, ductile, high elastic limit steel developed by Pacific Coast Steel Company. It has an elastic limit of 45,000 lb. and an elongation of 22% and is used by the Company in the manufacture of its

Transmission Towers and Poles
Switch Racks Platforms
Bus Structures Radio Towers
Electric Sign Supports



The accurate qualitative analysis made on each heat of Special Tower Steel is the double check on its quality and fitness for tower duty.

SPECIAL TOWER STEEL

PELTON

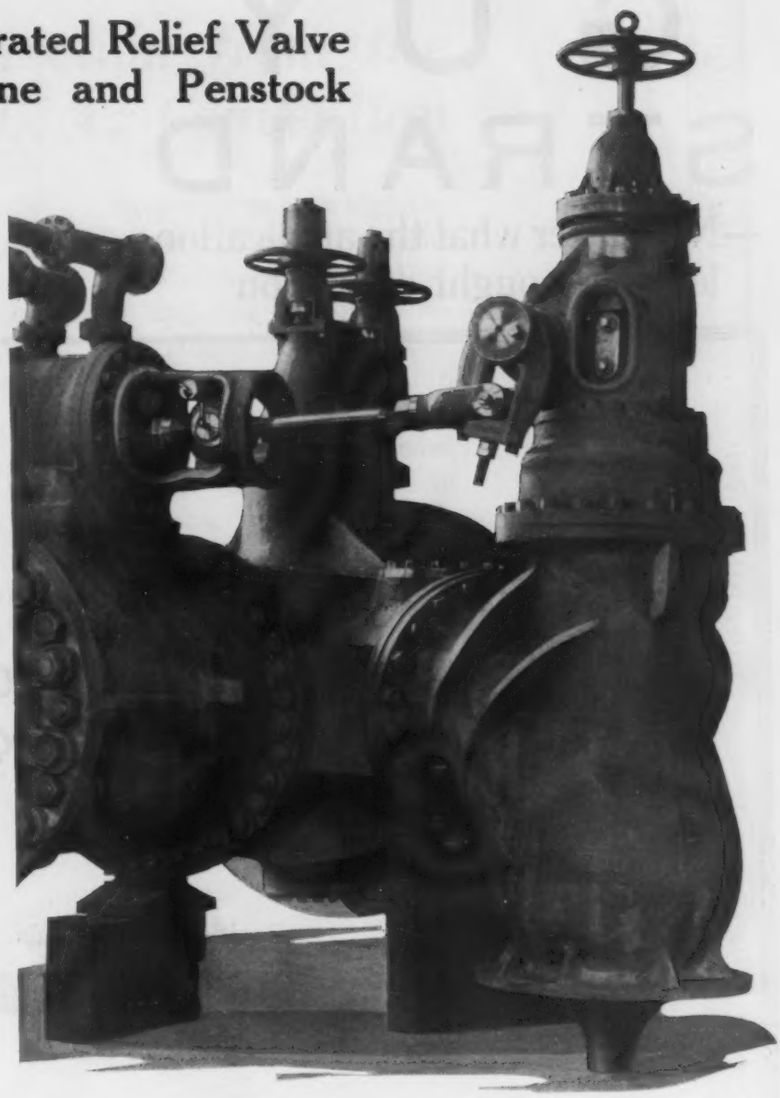
Distinctive Pelton Design

Mechanically Operated Relief Valve Safeguards Turbine and Penstock

Pelton relief valve design has proven its special fitness for reaction turbines under all heads since it affords complete protection to both turbine and penstock.

Pelton relief valves are mechanically connected to the governor with all parts strong enough to sustain the full effort of the governor and even to block governor movement in the event of debris or other obstruction hindering normal operation.

The relief valve not only performs an important function in the control of pressure rise in the penstock but also provides safety to the turbine and penstock in case of rupture in the pressure oil piping. An accident of this sort will cause the governor to relinquish control of the turbine, following which the guide vanes move to a closed position.



THE PELTON WATER WHEEL COMPANY

Hydraulic Engineers

2985 Nineteenth St., SAN FRANCISCO 100 Broadway, NEW YORK

Divisional Office in American Trust Building, Birmingham, Ala.

Associated Companies: Wm. Cramp & Sons Ship & Engine Bldg. Co., Philadelphia; Dominion Eng. Works, Montreal; Sociedade Anonyma Hilpert, Rio de Janeiro.

Pacific Coast Representative for The M. W. Kellogg Co., Jersey City, N. J.; Larner Engineering Co., Philadelphia; De La Vergne Machine Co., New York, N. Y.

PELTON

WHEN YOU THINK OF

GUY STRAND

—No matter what the application let this thought guide you

Pacific Guy Strand is made in a modern up-to-date Pacific Coast factory and fulfills all strain requirements.

—

It will pay you to let us figure with you.

Standard Quality
Adequate Stocks
Prompt Shipments

Pacific Guy Strands

Satisfy All Hands

MAYDWELL & HARTZELL
OUR NAME MAYDWELL SPELLS QUALITY
INCORPORATED

FACTORY DISTRIBUTORS

158-168 Eleventh St.
San Francisco

440 Seaton St.
Los Angeles

A Reflection from the N. E. L. A. Convention

"IT seems to be admitted everywhere that the electric light and power industry of the United States is far in advance of any other country in the world, and this cannot be regarded as a boast. It is simply a statement of fact; and, whether or not private ownership and control is completely responsible for this superiority, it has nevertheless come about under that system and no one is justified in saying that it would have been as far advanced under a government system of ownership and control."

. . . . From address by General Guy E. Tripp before San Francisco Electrical Development League, June 15, 1925.

Westinghouse

WESTINGHOUSE ELECTRIC

A Child Could Renew a Fuse In Perfect Safety

Long Life Switches

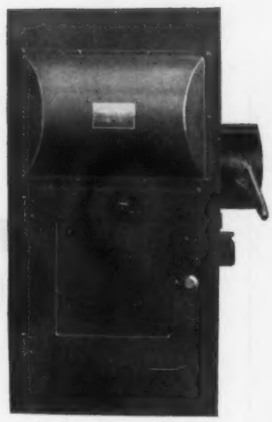
The cash value of safety is obvious.

Built for heavy duty industrial disconnect service, the WK-55 Safety Switch combines the necessary sturdiness of construction with a safety feature so efficient as to render it impossible for an employe to accidently come in contact with the live parts of the switch.

This full safety is accomplished by an inner door—a door within a door. The smaller door giving access to the fuse compartment cannot be opened until the handle is in the off position and all accessible parts are dead. The main door is padlocked and can be opened only by an authorized person. This double door arrangement also affords facilities for inspecting and testing the switch without interrupting service.

The WK-55 stands alone among the heavy duty industrial switches. It is the one switch that provides a full safety of operation with a design for long and continuous service.

Mail the coupon appearing below for detailed information about the other features of the WK-55.



WK-55 Full Safety Severe Service Switch

Westinghouse Electric & Manufacturing Company
Merchandising Department **Mansfield, Ohio**

Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

3400 rpm — yet a pencil stands on end

HERE is a Westinghouse motor running at 3400 rpm—and running so smoothly a pencil stands on end on the frame.

Some jobs call for motors with this delicate, vibrationless balance. Westinghouse balances *all* such motors *dynamically*—by an exclusive method.

What balance is to the engine of your automobile, balance also is to an electric motor when it runs at high speeds. Balanced motors are vibrationless; they live longer; bearings wear less; the apparatus driven by the motors does better work; also balanced motors are quiet.

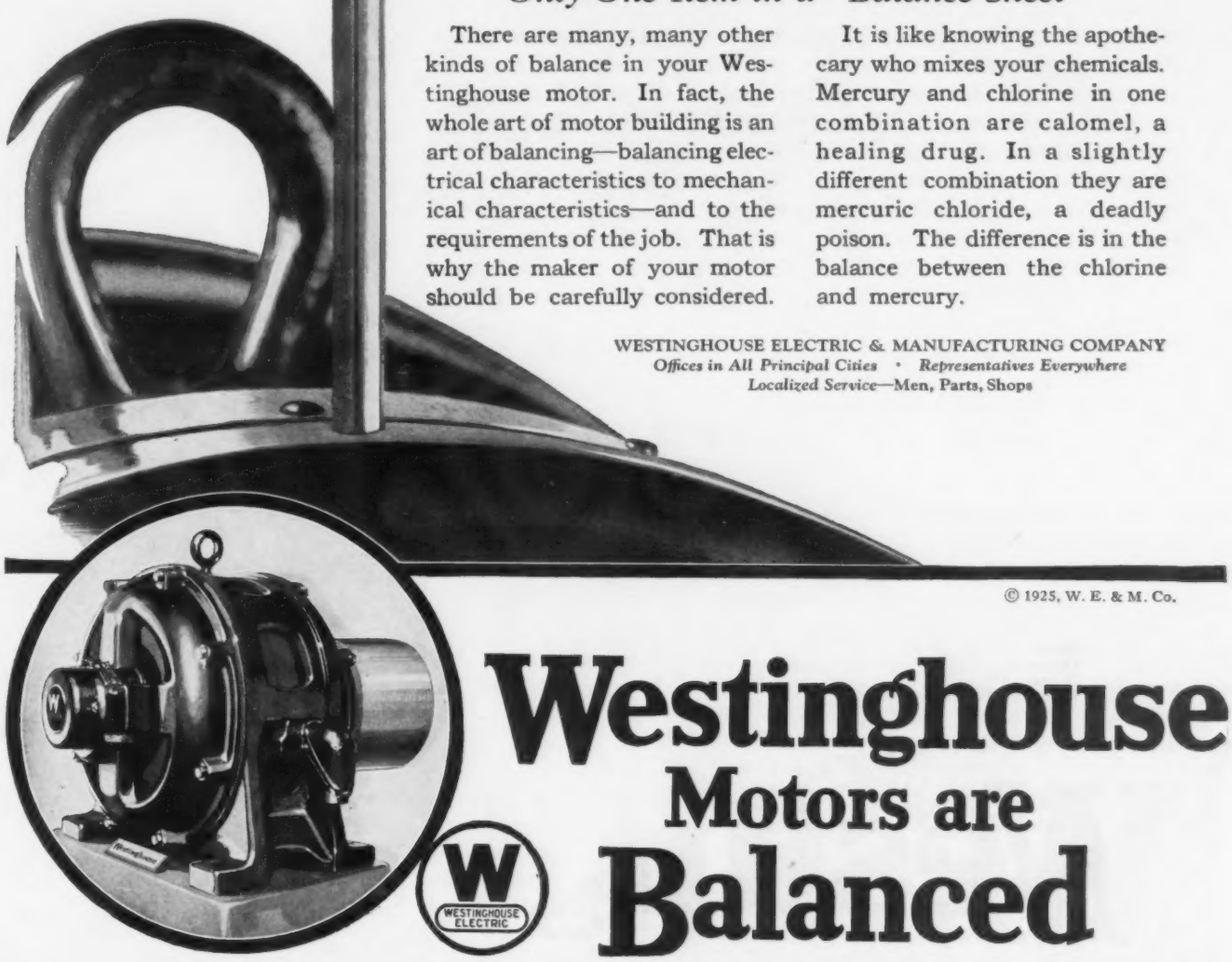
WESTINGHOUSE has been building motors since before the nineties. How the value to you in these motors has steadily increased is shown by comparing a five-horsepower motor today with one of its earliest progenitors. Today's motor weighs 75 per cent less, is 5 per cent more efficient, yet costs you only 10 per cent as much.

Only One Item in a "Balance Sheet"

There are many, many other kinds of balance in your Westinghouse motor. In fact, the whole art of motor building is an art of balancing—balancing electrical characteristics to mechanical characteristics—and to the requirements of the job. That is why the maker of your motor should be carefully considered.

It is like knowing the apothecary who mixes your chemicals. Mercury and chlorine in one combination are calomel, a healing drug. In a slightly different combination they are mercuric chloride, a deadly poison. The difference is in the balance between the chlorine and mercury.

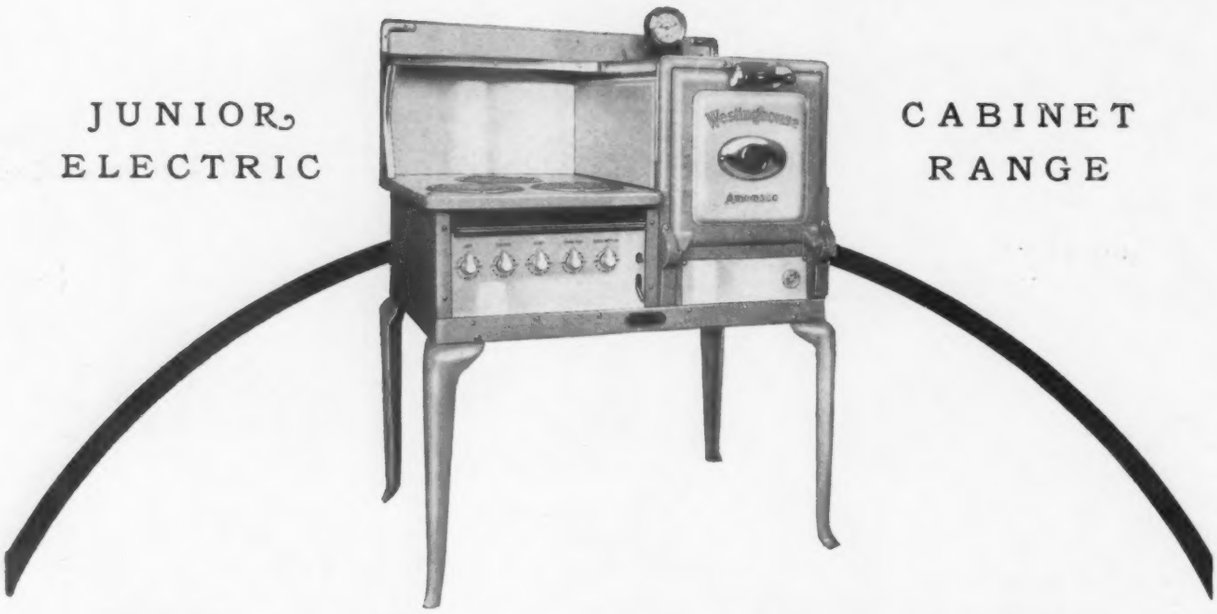
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
Offices in All Principal Cities · Representatives Everywhere
Localized Service—Men, Parts, Shops



© 1925, W. E. & M. Co.

Westinghouse Motors are Balanced

JUNIOR ELECTRIC



CABINET RANGE

The Range to Sell!

Westinghouse Junior Cabinet Automatic

It is easy to build a range business when the right range is selected.

The Westinghouse Junior Cabinet Automatic—the range with the clock—is the right range.

No other range has stronger selling features. No other range is backed by a stronger selling plan.

Investigate the Westinghouse Junior Cabinet Automatic. Our complete advertising and sales promotion campaign will be explained to you by your nearest district office, whose services are at your disposal.

Westinghouse Electric & Manufacturing Co.
George Cutter Works, South Bend, Ind.

Butte, 52 East Broadway
Casper, Wyo.
Denver, 910 Fifteenth St.
El Paso, Mills Building
Fresno, Griffith-McKenzie Bldg.
Los Angeles, 420 S. San Pedro St.
Portland, Porter Bldg.
Salt Lake City, So. Temple & W. Temple Sts.
San Francisco, 1 Montgomery St.
Seattle, 3451 E. Marginal Way
Spokane, 821 Old National Bank Bldg.
Tacoma, 615 Rust Bldg.
Tucson, 90 Church St.

Westinghouse

for the good of the service

THIS is the new Seal Beach station of the Los Angeles Gas and Electric Corporation. (Details in May 30 Electrical World.) Dwight P. Robinson & Company designed and constructed the station.

The Indoor Bus supports and Indoor Disconecting Switches were of Elpeco manufacture.

"for the good of the service"

ELPEC

ELECTRIC POWER EQUIPMENT CORPORATION

412-420 NORTH EIGHTEENTH ST. PHILADELPHIA, PA.

Western Representatives: C. E. INGALLS, Rialto Bldg., San Francisco, Cal.; EICHER & BRATT, 570 Colman Bldg., Seattle, Wash.

Do your instrument transformers permit accurate metering on varying power-factor?

PHASE-ANGLE errors in instrument transformers have a greater effect upon the registration of a watthour meter when the power-factor of the load is low than when the power-factor of the load is high.

In the ordinary single-stage transformer it is impossible to compensate for phase-angle errors at all power-factors, but *it is possible* to reduce the phase-angle error to such a small amount that it will not seriously impair the accuracy of the meter on varying power-factor.

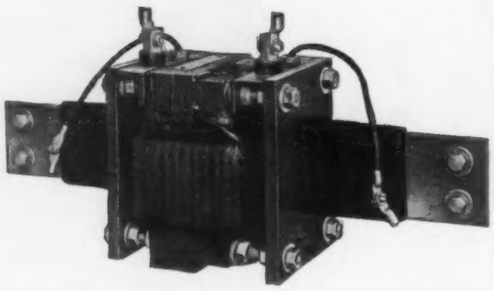
All Sangamo Instrument Transformers are designed and built to reduce ratio and phase-angle errors to a minimum in the service for which they are intended.

Types F and G Current Transformers are especially recommended for exceptionally high accuracy on varying load and power-factor conditions where the secondary burden is relatively heavy.

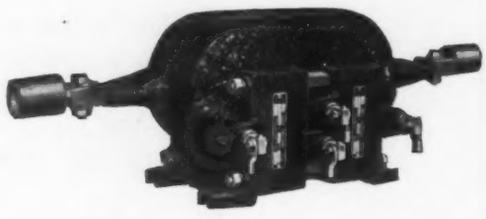
The Sangamo Two-stage Transformer is recommended where super-accuracy is desired under adverse conditions. This type of transformer, due to its two-stage construction, inherently and automatically compensates for ratio and phase-angle errors.

Write for Bulletin 65 which discusses the subject of instrument transformer accuracy and which shows characteristic curves for all types of Sangamo Instrument Transformers.

SANGAMO



Sangamo Type F-2S Current Transformer with two separate secondary circuits, one for meters and the other for auxiliary devices.

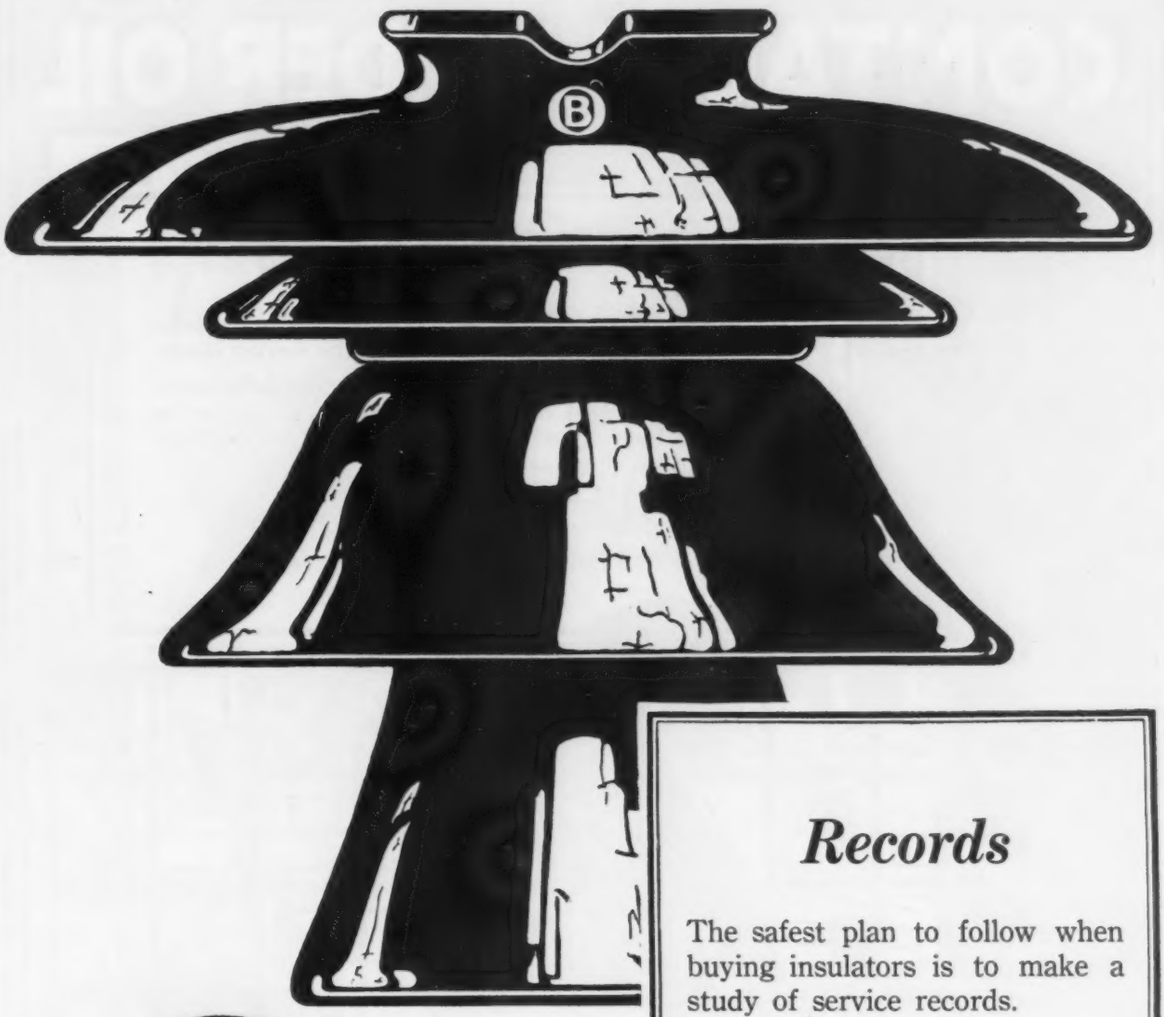


Sangamo Type BC Two-stage, Busbar-type Current Transformer. Also made in wound-primary, opening for busbar and bushing types.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS
New York Boston Chicago Birmingham San Francisco Los Angeles

1023-14

SANGAMO METERS
FOR EVERY ELECTRICAL NEED



Records

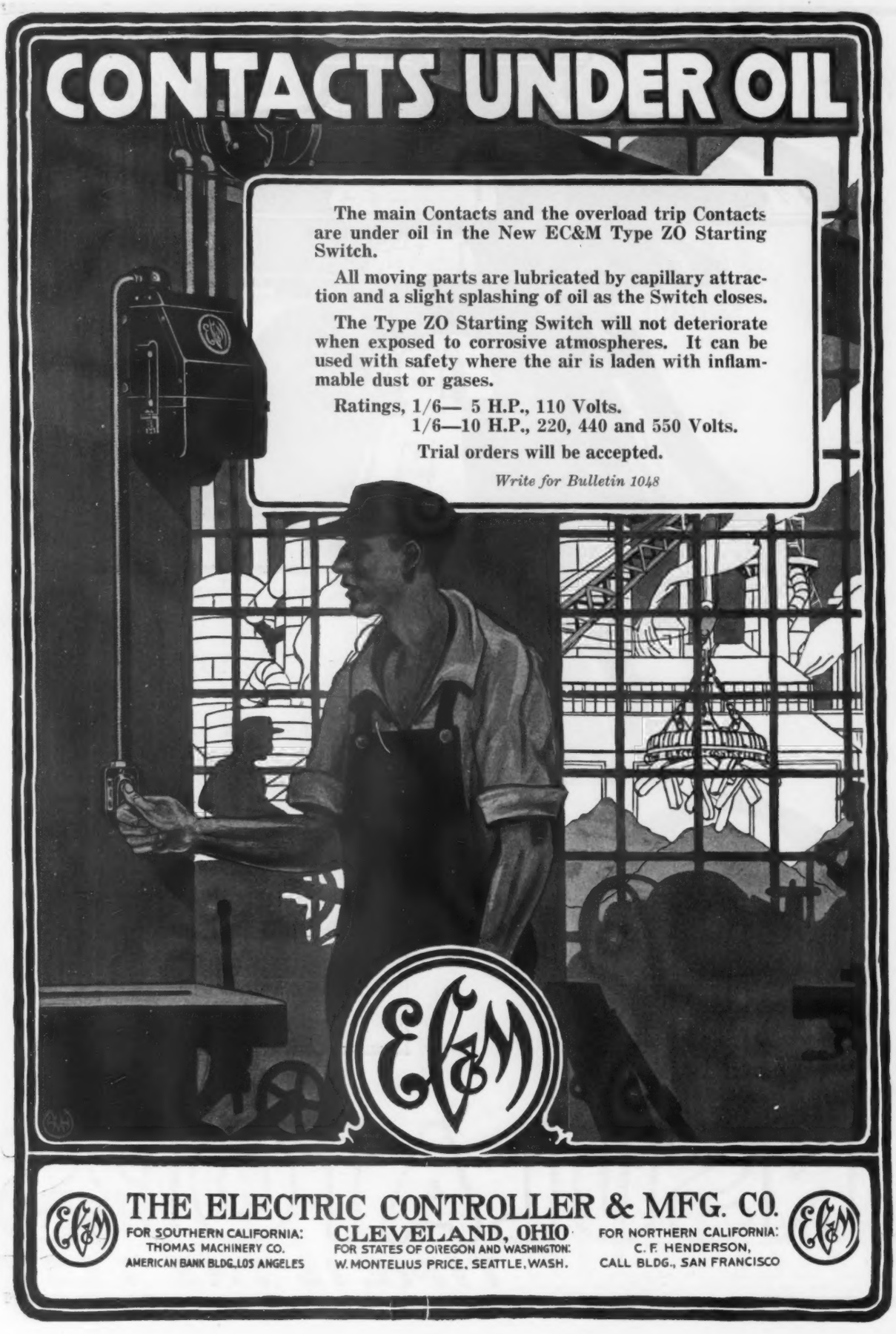
The safest plan to follow when buying insulators is to make a study of service records.

As an insulator has done, so may it be expected to do.

The Ohio Brass Company
Mansfield, Ohio, U. S. A.

B
INSULATORS
TIME IS THE TEST

CONTACTS UNDER OIL



The main Contacts and the overload trip Contacts are under oil in the New EC&M Type ZO Starting Switch.

All moving parts are lubricated by capillary attraction and a slight splashing of oil as the Switch closes.

The Type ZO Starting Switch will not deteriorate when exposed to corrosive atmospheres. It can be used with safety where the air is laden with inflammable dust or gases.

Ratings, 1/6— 5 H.P., 110 Volts.
1/6—10 H.P., 220, 440 and 550 Volts.

Trial orders will be accepted.

Write for Bulletin 1048

E&M

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND, OHIO

FOR SOUTHERN CALIFORNIA: THOMAS MACHINERY CO. AMERICAN BANK BLDG. LOS ANGELES

FOR STATES OF OREGON AND WASHINGTON: W. MONTELIUS PRICE, SEATTLE, WASH.

FOR NORTHERN CALIFORNIA: C. F. HENDERSON, CALL BLDG., SAN FRANCISCO

100 Years from NOW~

This SHERARDUCT Will be Young!

WHEN you protect wiring with Sherarduct Rigid Conduit you can be certain the conduit will last as long as the building. Sherarduct—an alloying of pure zinc with steel pipe under intense heat—is rust proof and non-corrosive—both inside and out. Threads and couplings are likewise protected and another advantage is that it can be "cold bent" right on the job.

Send for Sherarduct Booklet

National Metal Molding Company
1529 FULTON BUILDING
PITTSBURGH, PA.
Represented in All Principal Cities (x33)

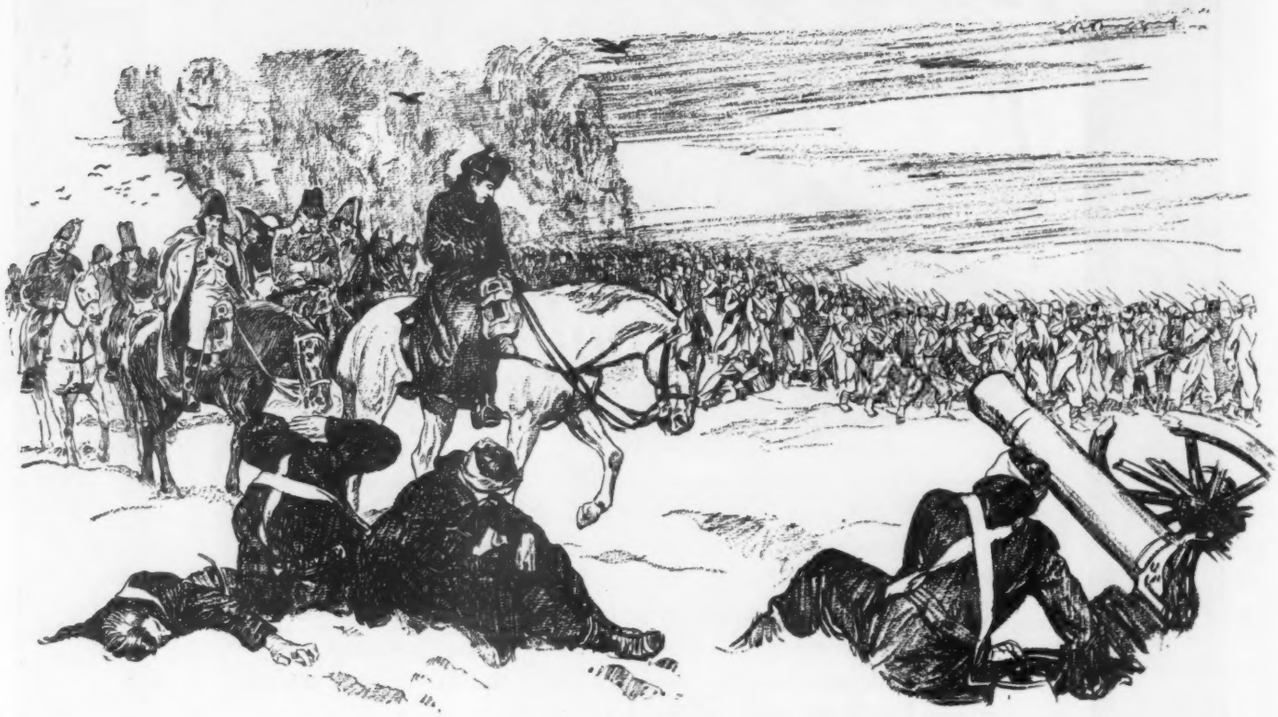
NATIONAL PRODUCTS

SHERARDUCT *and* ECONOMY RIGID CONDUIT
FLEXSTEEL~ *Flexible Conduit Armored Cable*
OVALFLEX *flat Armored Cable*
FLEXTUBE *'Loom'*
NATIONAL BRACKETS
METAL MOLDING *The Orginal Surface Raceway*
LIBERTY WIRES *Cable and Cords*
OUTLET *and Switch Boxes~*
CONDUIT FITTINGS

National WIRING Products

For a safe, economical wiring system that will last a life time

Can *Business* do what N



TEMPTED by visions of vast domains, Napoleon led his invincible army beyond the borders of Central Europe to conquer Russia's scattered millions. Conquest was easy; yet the "Little Corporal"—with Russia at his feet—was compelled to undertake that disastrous retreat from Moscow. *He could not support his army in the territory he had penetrated.*

Are the Napoleons of Industry facing a similar situation today? Striking parallels to Napoleon's profitless undertaking are found in many present-day methods of industrial marketing. Thousands of scattered prospects, without potential buying power, are tempting manufacturers to extend their operations beyond the border line of profitable selling.

Ninety-five per cent of industry's purchases are made by 115,000 buyers. These include everything worth-while from the great industrial plants to the little shops with a big future. The five per cent market is scattered, of uncertain stability and low potential. Any manufacturer who attempts to sell it is but inviting another "Retreat from Moscow."

Four principles of Industrial Marketing

The buyers who comprise the ninety-five per cent market are the men most interested in methods, machines and materials which will increase the efficiency of their plants. They form the real market for manufacturers who sell to industry. As a preliminary to selling them, these four basic facts should be determined: (1) What are the worth-while markets (2) What are the buying habits of those markets (3) What are the most direct channels of approach to them (4) What are the most effective appeals.

These are all definitely known, easily determinable. Any manufacturer who desires to sell efficiently and economically must know these things. The information is readily available through the McGraw-Hill Company.

PRINT IN BINDING

tNapoleon could not?

What three industrial leaders say—

OTTO H. FALK, *President*
Allis-Chalmers Manufacturing Company

"To achieve success in industrial selling it is necessary that sales efforts be built on a secure foundation of market analysis to define worthwhile markets. Sales specialization is equally important to obtain a full share of business from each market."

GERARD SWOPE, *President*
General Electric Company

"There are natural markets for every manufacturer, and entry into such a market carries with it a responsibility for stewardship.

"For any manufacturer not to intensively cultivate and serve a natural market he has selected causes economic waste, just as it does when he lightly enters other markets where he is not prepared to assume responsibility."

E. M. HERR, *President*
Westinghouse Electric & Mfg. Co.

"The reward of an attractive and profitable volume of business may be expected by the manufacturer who first selects worth-while markets and then builds a specialized sales and service organization to serve each. Such procedure escapes the high sales resistance that inevitably results from scattered selling."

(These statements are excerpts from letters to Mr. James H. McGraw)

Trained to see the trends in industry and to interpret their significance, the McGraw-Hill Publications pointed the way in the great production development of the past half-century.

And now, with a distinct trend towards the elimination of waste in distribution, the McGraw-Hill Company points the way to more scientific selling — with a wealth of data, a unique knowledge of the buying habits of industry, and a sincere desire to serve.

A unique service to manufacturers

The McGraw-Hill fingers are on the pulse of industry, contacting through fifteen publications. Some of these publications are spokesmen for whole industries, others for specific functions common to many industries. The intimate knowledge of industry thus acquired enables the McGraw-Hill Company to be of real service to manufacturers in lowering their costs of distribution.

It will be a pleasure to assist manufacturers and their advertising agents in such an undertaking. As a preliminary, it would be well to read "Industrial Marketing," which graphically covers the results of a recent survey of the buying habits of industry. This will be sent upon request to any manufacturer whose market embraces any of the industries covered by the McGraw-Hill Publications.

McGRAW-HILL COMPANY, INC., NEW YORK, CHICAGO, PHILADELPHIA, CLEVELAND, ST. LOUIS, SAN FRANCISCO, LONDON, PUBLISHERS OF

Mc GRAW-HILL PUBLICATIONS

REACHING A SUBSTANTIAL MAJORITY OF THE POTENTIAL BUYERS IN THE INDUSTRIES THEY SERVE

Mining
ENGINEERING & MINING JOURNAL PRESS
COAL AGE
Radio
RADIO RETAILING
RADIO TRADE DIRECTORY

Electrical
ELECTRICAL WORLD
JOURNAL OF ELECTRICITY
ELECTRICAL MERCHANDISING

Industrial
POWER . AMERICAN MACHINIST
CHEMICAL & METALLURGICAL ENGINEERING
INDUSTRIAL ENGINEER

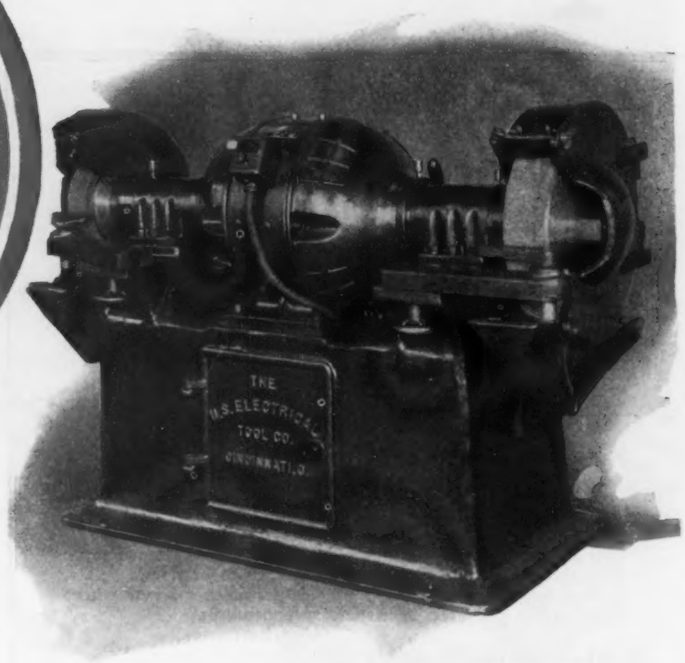
Overseas
AMERICAN MACHINIST (EUROPEAN EDITION)
INGENIERIA INTERNACIONAL

Construction & Civil Engineering
ENGINEERING NEWS-RECORD
Transportation
ELECTRIC RAILWAY JOURNAL
BUS TRANSPORTATION

This advertisement is the third of the series which is appearing in the following newspapers —*New York Times, Philadelphia Public Ledger, Pittsburgh Gazette-Times, Cleveland Plain Dealer, Detroit Free Press, Chicago Tribune* and *New York Herald-Tribune;* in the following advertising papers—*Printers' Ink, Advertising and Selling Fortnightly, Class,* and in the McGraw-Hill Publications. The purpose of these advertisements is to arouse a national appreciation of the need for improving industrial sales efficiency, and to awaken a keener interest in the correct principles of industrial selling.

"MEETS THE UNIFORM NEED THAT GOES WITH HIGH SPEED"

SKF
Puts the Right Bearing in the Right Place



SKF is linked with a world-wide reputation for delivering satisfactory service, and to an investment too large to be jeopardized by non-performance of anything with which it is connected.

Therefore SKF provides a supervision of factories throughout the world and an international organization for scientific research in engineering, manufacturing and merchandising to assure to the user a full measure of performance in products endorsed with the mark SKF.

Accurate Work and High Production Easily Maintained on Ball Bearing Electric Grinders

IN heavy service to which this double-end electric grinder is subjected, where unvarying accuracy of finished product and a uniform flow of production are highly essential, Skayef Self-Aligning Ball Bearings have fully proved their adaptability under all conditions.

They eliminate the chatter and vibration due to wear of plain bearings and keep the wheels true. Wear is a negligible quantity, original settings are always insured, and electrical troubles are reduced to a minimum. Dust and grit are effectively excluded from the bearings by sealed housings.

SKF INDUSTRIES OF CALIFORNIA, INC.

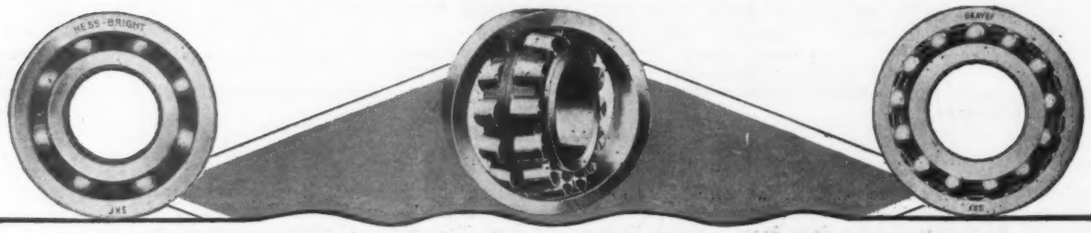
115 New Montgomery St.
San Francisco
Phone: Sutter 4196

(A complete Line of Radial and Thrust Ball Bearings Carried in Stock)

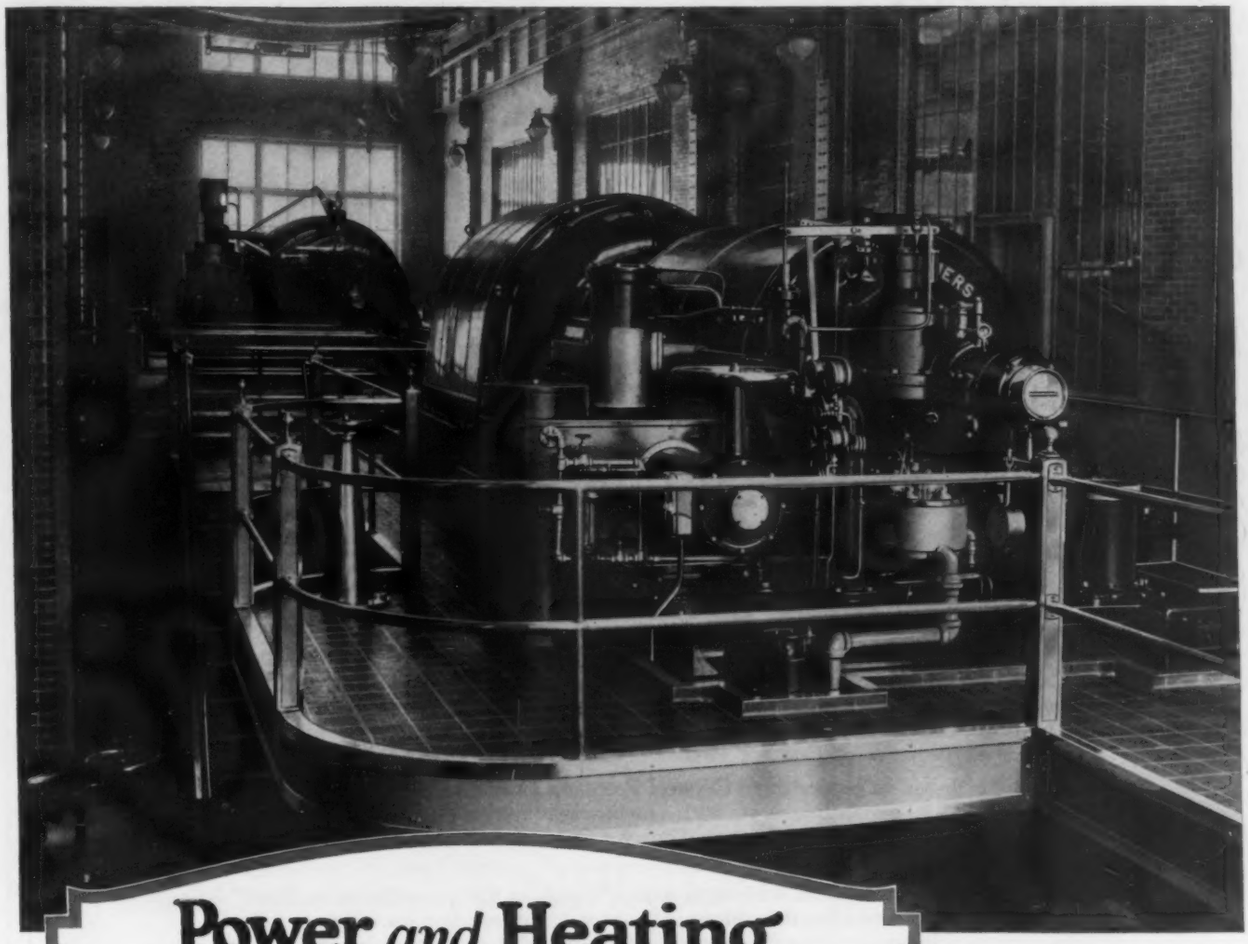
1114 South Hope St.
Los Angeles
Phones: 875-365

"More than 100 factory offices throughout the world"

1413



BALL AND ROLLER BEARINGS



Power *and* Heating Efficiently Combined

The Power Plant of the Ford factory at Ford City, Ontario, economically combines power production throughout the year with winter heating.

Allis-Chalmers Steam Turbine Units were chosen for this unusual combination.

The two units of 10,000 K.W. and 5,000 K.W. rating operate normally condensing but when heat is required the smaller unit operates with reduced vacuum, the warm circulating water delivering heat to the Plant.

Vacuum is reduced as heat requirements increase and provision is made for extracting additional steam from the larger unit during periods of severe cold. This arrangements meets heating requirements with a minimum of energy loss.

The turbine equipment making this high economy possible is the product of the Allis-Chalmers Organization, which is ready to serve you in any power problem. Additional details will be gladly furnished on request.

PRODUCTS

Steam Turbines
Hydraulic Turbines
Electrical Machinery
Steam Engines
Gas Engines
Condensers
Oil Engines
Pumping Engines
Centrifugal Pumps
Mining Machinery
Metallurgical Machinery
Crushing Machinery
Cement Machinery
Flour Mill Machinery
Saw Mill Machinery
Air Compressors
Air Brakes
Steam and Electric Hoists
Farm Tractors
Power Transmission Machinery
Timber Preserving Machinery

ALLIS-CHALMERS

MILWAUKEE, WIS., U. S. A.

Why Porcelain Enameled Steel Reflectors are Better for Window Lighting

Certain sole points of merit have demonstrated beyond all dispute the superiority of Benjamin Porcelain Enameled Reflectors for Industrial and Commercial Buildings. The same exclusive Benjamin features adapt these reflectors preeminently for the lighting of Show Windows.

Because of inherent properties in Crysteel Porcelain Enamel, a great flux of light, free from streaks and garish beams, yet with a mellowness not possible with other reflecting surfaces, is directed to the goods upon display. Direction and diffusion are accomplished by one reflector.

Crysteel Porcelain Enamel, whitest of white, "Clean as Crystal—Strong as Steel," is impervious to heat or other deleterious influences. It will not discolor, stain nor tarnish. Its unbreakable surface is easily cleaned of offending dirt or dust with a damp cloth.

Its peculiar characteristics make it especially advantageous for reflecting true color value, thus dressing up and animating window displays.

There is also a considerable saving in the cost of a window installation with Benjamin Porcelain Enameled Steel Reflectors.

No. 15103N, the "Puttee," is a splendid general purpose reflector for all windows of usual dimensions and where ordinary intensities of illumination are required.

No. 15106N, the "Spat," is used in all windows of usual dimensions where higher intensities are required, and is especially adaptable for flush mounting with false ceilings.

BENJAMIN

No. 1406

No. 4377

Make your windows double purpose windows—Benjamin Reflectors will not only improve the display and attract more business, but also permit you to explain the simple installation methods and demonstrate to prospective customers the exceptional results they can expect in their own show windows.

Benjamin installation fittings make it easy to install the Benjamin Reflectors. They also enable the window trimmer to quickly detach the reflector for cleaning and then just as quickly return it to its place. No. 1406 has screw thread for shade holder No. 4377.

For color lighting the Laco Colorlite is ideal—it permits the use of full color effects to bring out the beauty of goods under display. There is a choice of amber, red, green and blue. The illustration shows how it attaches to the lamp. Readily put on or taken off.

Laco Colorlite

Benjamin Electric Mfg. Co.

247 West 17th Street
New York

120-128 South Sangamon Street
Chicago

448 Bryant Street
San Francisco

Manufactured in Canada by the Benjamin Electric Mfg. Co. of Canada, Ltd., Toronto, Ontario

DIRECTORY of ENGINEERS

The Journal of Electricity's selected list of Engineers equipped to handle Hydro-Electric and Industrial Development now under way in the West

BYLLESBY
ENGINEERING & MANAGEMENT CORPORATION
231 S. La Salle Street, Chicago
New York Tacoma

FORD, BACON & DAVIS
Incorporated
ENGINEERS
115 Broadway, NEW YORK
Philadelphia Chicago San Francisco

GEORGE L. HOXIE
CONSULTING ENGINEER
Engineering Economics
Los Angeles, Calif.

JAMES R. CRAVATH
Consulting Illuminating Engineer
1113 Macdonald Avenue,
Richmond, Calif.
San Francisco Conferences by Appointment
Telephone Richmond 17 — Formerly of Chicago

G. M. GEST
Constructors of
Electrical Underground Conduit Systems
Founded 1896
503 Market St.
San Francisco, Calif.

LOUIS F. LEUREY
INDUSTRIAL APPLICATIONS OF ELECTRICITY
58 Sutter Street San Francisco, Calif.

ELECTRICAL TESTING LABORATORIES
Electrical, Photometrical, Chemical a. Mechanical Tests. Inspections of Materials a: Apparatus at Manufactory.
80th Street and East End Avenue
New York

ARTHUR R. KELLEY
CONSULTING ENGINEER
Reports and Valuations, Public Utility and Industrial Properties
Nevada Bank Bldg San Francisco

THE J. G. WHITE ENGINEERING CORPORATION
Engineers—Constructors
Oil Refineries and Pipe Lines, Steam and Water Power Plants, Transmission Systems, Hotels, Apartments, Office and Industrial Buildings, Railroads.
43 Exchange Place New York

DWIGHT P. ROBINSON & COMPANY
INCORPORATED
Design and Construct
Power Plants — Hydro-Electric Developments
Industrial Plants — Railroad Shops and Terminals
UNION OIL BUILDING, LOS ANGELES
New York Chicago Montreal Atlanta Philadelphia Rio de Janeiro

THEBO, STARR & ANDERTON, INC.
ENGINEERS AND CONSTRUCTORS
Specializing in Design and Construction of Power Plants, Hydro-Electric, Irrigation and Industrial Projects
Appraisals, Investigations, Reports, Plans and Specifications
San Francisco Tokio Los Angeles

SANDERSON & PORTER
Established 1896
Design and Construct
Organize, Manage, Operate and Finance
PUBLIC UTILITIES AND INDUSTRIALS
14 Montgomery St., San Francisco
New York Chicago

Just Published—

A Book Every Radio Fan Should Own

MOYER and WOSTREL

Practical Radio Including the Testing of Radio Receiving Sets

248 Pages
5½ x 8
Illustrated

This book presents the fundamental principles of radio so simply and clearly that any preson of average training will be able to understand and apply them. The book tells what radio is, how it works, how to select, operate and care for radio receiving sets; how to construct receiving sets; how to test your set; how to locate common troubles and remedy them.

Price
$1.75
Postpaid

TECHNICAL BOOK SHOP
883 Mission Street San Francisco
Phone Kearney 918

READY REFERENCE FOR WESTERN BUYERS

ALEXANDER AND LAVENSON
ELECTRICAL SUPPLY COMPANY

Fada Neutrodyne Radio Sets; Crosley Radio Receivers; Eveready Flashlights and Batteries; Manning-Bowman Heating Appliances, Square D Switches, Noark Fuses; Bryant Materials, Westinghouse Lamps; Insulating Supplies, Benjamin Industrial Lighting, Hubbell Devices; Magnavox Heaters and Lamps, Wessix Electric Heaters and L & H Ranges.

926 Howard Street, San Francisco, Cal.

John A. Roebling's Sons Co.
of California

San Francisco Los Angeles
Portland Seattle

Wire Rope
Blocks and Fittings
Electric Wires and Cables
Wire Cloth and Netting
Wire Products

Listenwalter & Gough, Inc.
JOBBERS OF
Electrical Supplies

Distributors for
Royal Electric Cleaners
Standard Electric Ranges
Manning-Bowman Heating Appliances
Zenith Radio
Lincoln and Williamson Fixtures
Royal Monax Lighting Units
Yale Flashlights

San Francisco Los Angeles

NEW YORK CHICAGO SEATTLE

FEDERAL ELECTRIC COMPANY

Federal Sirens: What the Navy Thinks of Them
"Federal Sirens of the Norfolk Navy Yard test ran practically twice as long as the only competitor."
"On the question of durability and effectiveness the sirens met all requirements."

Western Factory: Emeryville Station, Oakland, Calif. Sales Offices: 91 New Montgomery St., San Francisco; 529 Electric Bldg., San Diego; 118 East Third Street, Los Angeles; 2718 Elliott Avenue, Seattle, Wash.

SAN FRANCISCO
OAKLAND LOS ANGELES SAN DIEGO

The Montana Electric Co.
Butte, Montana

The Washington Electric
Supply Co.
Spokane, Washington

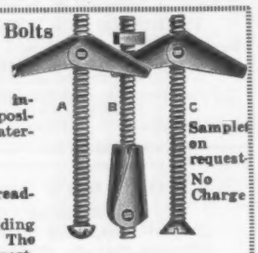
Distributors for: Anaconda Copper Mining Co.; "A&F" Water Heaters and Covers; Hurley Machine Co.; Crouse-Hinds Co.; Landers, Frary & Clark; Chicago Insulated Wire & Mfg. Co.; W. N. Matthews; Bryant Electric Co.; Radio Corporation of America. Westinghouse Electric & Mfg. Co.; Westinghouse Lamp Co.; R. Williamson & Co.

REIMAN WHOLESALE
ELECTRIC COMPANY

Jobbers and Distributors
— of —
WIRING MATERIALS
APPLIANCES
GLASSWARE and FIXTURES
RADIO SUPPLIES
224-228 East Third St.,
Los Angeles, Calif.

Paine Toggle Bolts

The only spring type toggle on the market. The wings will open instantly in any position in hollow material.
Any style head.
Any length bolt.
Standard bolts threaded to head.
Requires no guiding — just insert — The spring does the rest.



Samples on request. No Charge

The Paine Company, Chicago, Ill.

Stock Carried: J. J. Noble, 952 Folsom St, San Francisco, Calif. Rep., J. J. Schaller, 257 Spring St., Los Angeles, Calif.

Technical Book Shop
883 Mission Street
San Francisco

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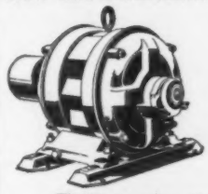

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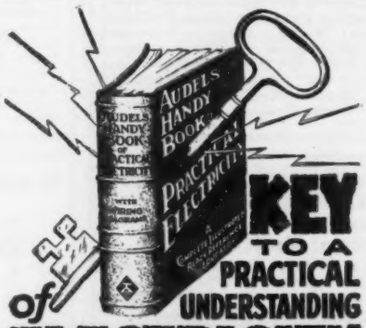

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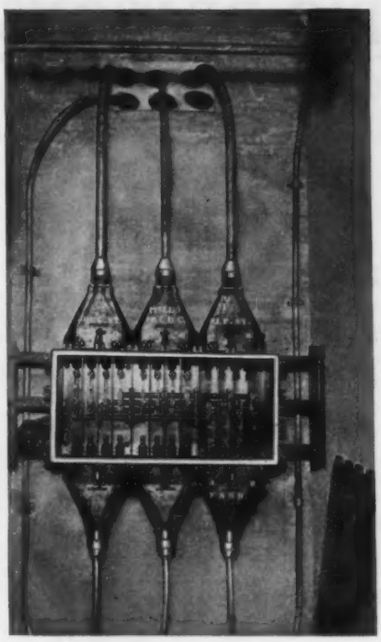

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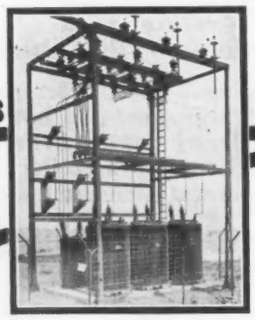

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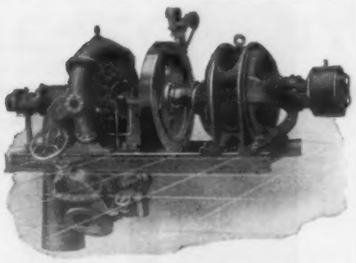

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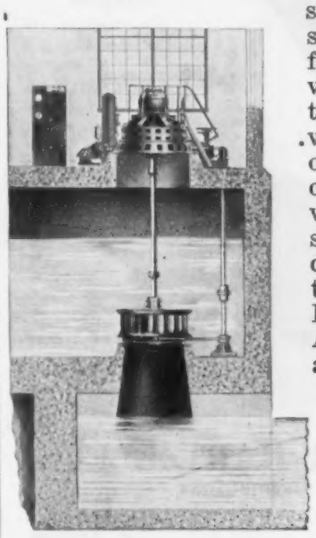

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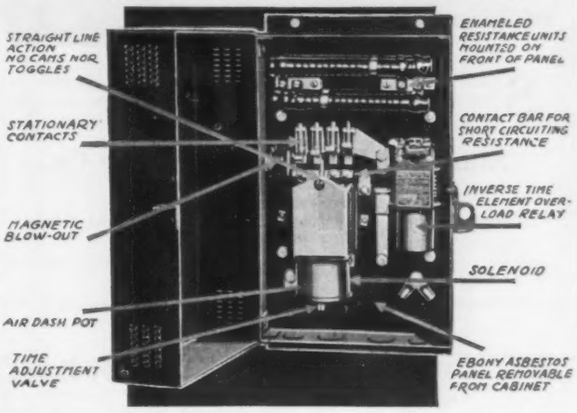
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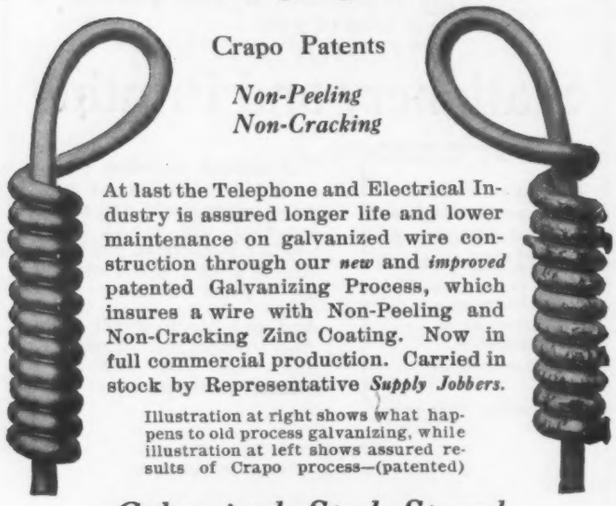

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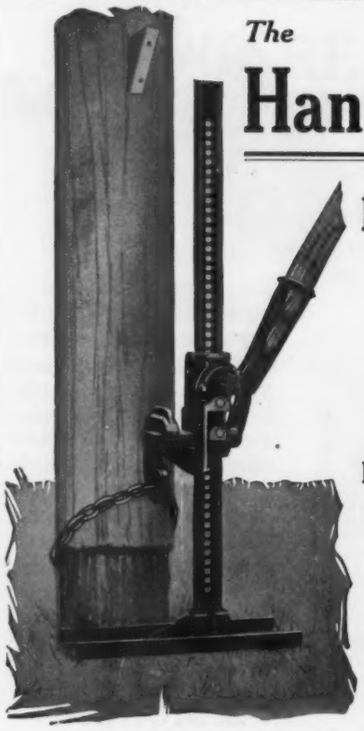

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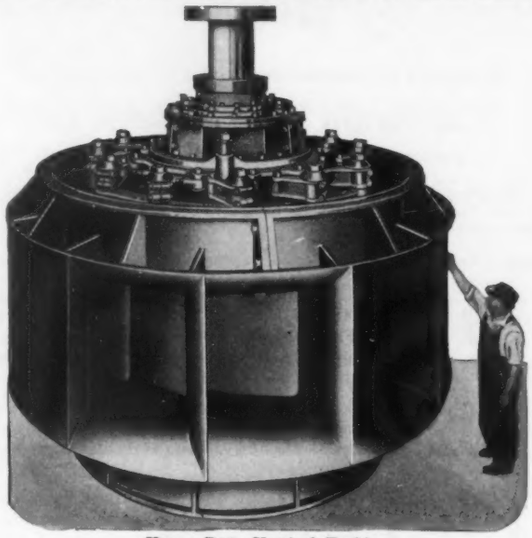

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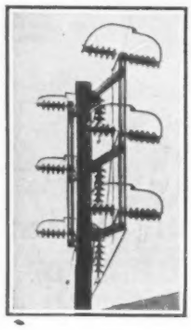

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Condit Electrical Mfg. Co.
General Electric Company
Maydwell & Hartzell, Inc.
Pacific States Electric Company
Roller-Smith Company
Trumbull Electric Mfg. Co.
Ward Leonard Electric Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Clusters
Benjamin Electric Mfg. Co.
Pacific States Electric Company
Western Electric Company

Coils
General Electric Company
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Compounds, Insulating and Splicing
Appleton Rubber Co.
Baker-Joslyn Company
Electrical Specialty Co., Inc.
Mica Insulator Co.
Okonite Company, The

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OK non-raveling

FRICTION TAPE and OK SPLICING COMPOUND for SAFE, PERMANENT JOBS

Jobbers in all principal centers

Western Representatives:

The George A. Gray Co.

San Francisco, Calif.

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An absolutely straight shovel, stronger, stiffer and one that will dig holes straight and uniform with greater ease.

There is a complete line of Oshkosh Tools. Prompt shipments. Write for illustrated catalog.

LEACH COMPANY
Oshkosh, Wisconsin

OSHKOSH
POLE LINE CONSTRUCTION TOOLS

—1

CHAS. C. MOORE & CO. ENGINEERS INC.

Contractors for Complete Plants

HIGH GRADE MACHINERY

The Babcock & Wilcox water tube boilers
Corliss high speed and poppet valve engines
Babcock & Wilcox superheaters
Nordberg hoists and compressors
Green's fuel economizers
Wheeler Condenser & Engineering Co. condensing machinery
Cochrane feed water heaters
Sorge-Cochrane feed water softeners
Cochrane feed water metering heaters
Cochrane steam separators
Reilly evaporators, distillers and feed water heaters
Criscom-Russell multiwhirl coolers
Moore automatic fuel oil regulators
Diamond soot blowers
Lagonda tube cleaners
Copes feed water regulators
Lagonda automatic boiler stop valves
Leslie reducing valves
Turner oil filters

And All Power Plant Auxiliaries

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Los Angeles, I. N. Van Nuys Bldg. Seattle, L. C. Smith Bldg.
Salt Lake City, 705-6 Kearns Bldg. Tucson, 21 South Stone Ave.
Honolulu, T. H.

AJAX—No. 33 Plural Socket Plug

TRIPLE SOCKET PLUG

Leaves Lamp in Position Intended.

List Each 75¢

Greatest Value and Fastest Selling Item of This Character

Guaranteed Against All Damage from Heat, Moisture or Breakage

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AJAX ELECTRIC SPECIALTY COMPANY—St. Louis

Atlantic-Pacific Agencies Corp., 204 Rialto Bldg., San Francisco
R. Wolfsberg, 1851 Industrial Street, Los Angeles

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"OK" Weatherproof Wire
"Parac" Rubber Wire
Slow Burning Wire
Bare Copper Wire

PHILLIPS WIRE COMPANY
Pawtucket, R. I.

WHERE TO BUY

CLASSIFIED INDEX TO ADVERTISERS

Pacific States Electric Company
Standard Underground Cable Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Condensers, High-Voltage
Wireless Specialty Apparatus Co.

Condensers, Steam
Allis-Chalmers Mfg. Company
Moore & Company, Chas. C.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Conductors, Armored
Baker-Joslyn Company
Maydwell & Hartzell, Inc.
National Metal Molding Co.
Pacific States Electric Company

Conduit
Baker-Joslyn Company
Berry, A., Hall
Clifton Mfg. Co.
General Electric Company
Johns-Manville, Inc.
Middlesex Mfg. Co.
National Metal Molding Co.
Pacific States Electric Company
Tubular Woven Fabric Co.
Western Electric Company
Youngstown Sheet & Tube Co., The

Conduit Boxes and Fixture Switches
Jenkins Mfg. Co.
Pass & Seymour, Inc.

Conduit Fittings
Baker-Joslyn Co.
Chicago Fuse Mfg. Co.
General Electric Company
National Metal Molding Co.
Pacific States Electric Company
Reiman Wholesale Elec. Co.
Western Electric Company

Connectors
Maydwell & Hartzell, Inc.
Pacific States Electric Company
Sherman Mfg. Company, H. B.
Westinghouse Electric & Mfg. Co.

Contactors, A.C. and D.C.
Electric Controller & Mfg. Co.
General Electric Company
Industrial Controller Co.
Westinghouse Electric & Mfg. Co.

Controllers, Motor
Electric Controller & Mfg. Co.
General Electric Company
Industrial Controller Co.
Wagner Electric Corporation
Ward Leonard Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Converters
General Electric Company
Wagner Electric Corporation
Westinghouse Electric & Mfg. Co.

Cord
Baker-Joslyn Company
Collyer Insulated Wire Co.
Indiana Rubber & Ins. Wire Co.
Maydwell & Hartzell, Inc.
Okonite Company, The
Pacific States Electric Company
Rockbestos Products Corp.
Simplex Wire & Cable Co.
Tubular Woven Fabric Co.
Western Electric Company

Cut-outs
Arrow Electric Co., The
Chicago Fuse Mfg. Co.
Hart & Hegeman Mfg. Co.
Johns-Pratt Company, The
Pacific States Electric Company
Pass & Seymour, Inc.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Cut-outs, Transformer
Wagner Electric Corporation

Dimmers, Theater
General Electric Company
Ward Leonard Electric Company

Dynamos
Allis-Chalmers Mfg. Company
General Electric Company
Wagner Electric Corporation
Westinghouse Electric & Mfg. Co.

Engineers, Construction
Robinson & Co., Inc., Dwight P.
Stone & Webster, Inc.
Thebo, Starr & Anderton

Engines, Gas and Steam
Allis-Chalmers Mfg. Company
Moore & Company, Chas. C.
Westinghouse Electric & Mfg. Co.

Fans, Portable, Ceiling
Emerson Electric Mfg. Co.
General Electric Company
Pacific States Electric Company
Signal Electric Mfg. Co.
Wagner Electric Corporation
Western Electric Company
Westinghouse Electric & Mfg. Co.

Fans, Exhaust
Allis-Chalmers Mfg. Company
General Electric Company
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Fault Finders, Electric
Electric Controller & Mfg. Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Fibre
Continental Fibre Co., The
Johns-Manville, Inc.
Pacific States Electric Company
Westinghouse Electric & Mfg. Co.

Fixtures, Fixture Parts
Benjamin Electric Mfg. Co.
Curtis Lighting, Inc.
Harvey Hubbell, Inc.
National Metal Molding Co.
Pacific States Electric Company
Pass & Seymour
Sherman Mfg. Company, H. B.
Western Electric Company

Flash Lights, Electric
Pacific States Electric Company
Trumbull Electric Mfg. Co.
Western Electric Company

Flood Light Projectors
Curtis Lighting, Inc.
General Electric Company
Westinghouse Electric & Mfg. Co.

Furnaces, Electric
Hagan Co., Geo. J.
Detroit Elect. Furnace Co.
Westinghouse Electric & Mfg. Co.

Furnaces, Temperature Elements
American Resistor Co.

Fuses and Fuse Specialties
Baker-Joslyn Company
Chicago Fuse Mfg. Co.
D. & W. Fuse Works of G. E. Co.
Electrical Specialty Co., Inc.
Federal Electric Company
Hart & Hegeman Mfg. Co.
Johns-Pratt Company, The
Matthews Corp., W. N.
Metropolitan Electric Mfg. Co.
Monarch Fuse Co.
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

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WHERE TO BUY

CLASSIFIED INDEX TO ADVERTISERS

Governors
Allis-Chalmers Mfg. Company
General Electric Company
Pelton Water Wheel Co.

Ground Clamps
Sherman Mfg. Co.

Guards, Lamp
Benjamin Electric Mfg. Co.
Harvey Hubbell, Inc.
Pacific States Electric Company
Western Electric Company

Hangers, Lamp, Fixture, Cable
Baker-Joslyn Company
Hubbard & Company
Ohio Brass Company, The
Pacific States Electric Company
Standard Underground Cable Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Headlights, Electric
General Electric Company
Westinghouse Electric & Mfg. Co.

Heaters, Air
Electric Heating & Mfg. Co.
Hicks, W. Wesley
Westinghouse Electric & Mfg. Co.

Heating Elements, Electric, Non-Metallic, Industrial and Domestic
American Resistor Company
Hagan Co., Geo. J.

Heating Equipment, Electric
Hagan Co., Geo. J.
Westinghouse Electric & Mfg. Co.

Heating Equipment, Domestic
Edison Electric Appliance Co.
Electric Heating & Mfg. Co.
General Electric Company
Hicks, W. Wesley
Lindermann & Hoverson Co., A. J.
Majestic Electric Appliance Co.
Pacific States Electric Company
Reiman Wholesale Elec. Co.
Standard Electric Stove Co.
United Electric Co.
The Frank E. Walcott Mfg. Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Hoists, Air Motor
Ingersoll-Rand Co.

Hoists, Electric
General Electric Company
Moore & Company, Chas. C.

Hoods, Street
Benjamin Electric Mfg. Co.
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Industrial Signals
Benjamin Electric Mfg. Co.

Instruments, Recording, Testing
Jewell Elec. Instrument Co.
Maydwell & Hartzell, Inc.
Pacific States Electric Company
Roller-Smith Company
Sangamo Electric Co.
Taylor Instrument Companies
Western Electric Company
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Insulating Material
Bakelite Corporation
Baker-Joslyn Company
Electrical Specialty Co., Inc.
General Electric Company
Irvington Varnish & Insulator Co.
Johns-Manville, Inc.
Mica Insulator Company
Pacific States Electric Company
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

Insulation, Boiler and Pipe
Johns-Manville, Inc.

Insulations, Moulded
Johns-Manville, Inc.

Insulators
Baker-Joslyn Company
Champion Switch Co.
General Electric Company
Hemingray Glass Co.
Jeffery-Dewitt Insulator Co.
Lapp Insulator Co., The
Locke Insulator Corp.
Maydwell & Hartzell, Inc.
Ohio Brass Company, The
Pacific States Electric Company
Thomas & Sons Company, The R.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Ironer, Electric
Horton Mfg. Co.

Lamp Replacer
G. C. A. Mfg. Co., The

Lamp Locking Socket
Pass & Seymour, Inc.

Lamps, Incandescent
Edison Lamp Works of G. E. Co.
Mazda Service of G. E. Co.
National Lamp Works
Pacific States Electric Company
Reiman Wholesale Elec. Co.
Western Electric Company
Westinghouse Lamp Company

Lamps, Smokers'
Lees Co., K. F.

Lamp Standards
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Lightning Arrester Resistances
American Resistor Co.

Line Material, Pole, Railway
Baker-Joslyn Company
General Electric Company
Hubbard & Company
Locke Insulator Corp.
Matthews Corp., W. N.
Maydwell & Hartzell, Inc.
Ohio Brass Company, The
Pacific States Electric Company
Thomas & Sons Company, The R.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Locknuts and Bushings
Baker-Joslyn Company
National Metal Molding Co.
Pacific States Electric Company

Machinery, Mining
AllisChalmers Mfg. Co.
General Electric Company
Westinghouse Electric & Mfg. Co.

Magnets, Lifting
Electric Controller & Mfg. Co.
Ohio Electric & Controller Co.

Marine Lighting and Signaling Apparatus
Benjamin Electric Mfg. Co.
General Electric Company
Westinghouse Electric & Mfg. Co.

Meters
Duncan Electric Mfg. Co.
General Electric Company
Jewell Elec. Instrument Co.
Roller-Smith Company
Sangamo Electric Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Meter Testers
Johns-Pratt Company, The

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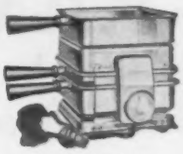
L&H Electrics Irons


L&H Electrics Table Stoves

There is an L&H Electrics to Satisfy Every Customer

Dealers who carry L&H Electrics Ranges say that sales are simply a matter of display—not effort.

That is because this line offers superior, improved features which customers are quick to appreciate. For example, the **Full Automatic L&H Electrics Time and Temperature Controls,** and other important factors, such as rust-poof, porcelain enamel finish; one-piece ovens with rounded corners, porcelain enameled inside and out; removable high speed elements; heavy knife blade contact connections, etc. And there are models to fit every individual need, whether for compact apartments or spacious homes.

The best jobbers are prepared to supply you with L&H Electrics Ranges and Appliances—or write to us for detailed information. Learn how to speed up turnover and boost profits on ranges this year.

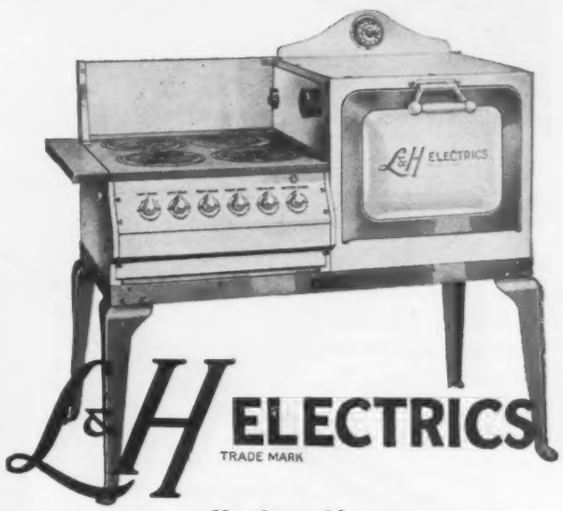
L&H Electrics Heaters

L&H Electrics "Turnsit" Toasters

Our Line of Electric Appliances Also Includes:
Hot Plates
Curling Irons
Heating Pads
Waffle Irons
Urn Heaters
Testing Ovens

Full Automatic Time and Temperature Controls

Both are automatic features of L&H Electrics Ranges—easy to operate and absolutely dependable. The Time Control is much simpler than a clock. Accurate and unfailing, you set it at the time you want your cooking to start and stop. The Temperature Control regulates and maintains even heat, automatically stopping and starting current so that temperature does not vary. Saves 60% of current.



L&H ELECTRICS
TRADE MARK

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Long Beach Building, New York, N. Y. L&H Building, Chicago, Ill.
1636 14th St., Denver, Colo. Rialto Building, San Francisco, Calif.

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—backed by over 35 years of experience

Backed by over 35 years of experience, N. Y. Insulated Wires and Cables are noted for their high quality and dependability. Every coil is severely tested to insure the same high standards. Engineers and contractors everywhere specify:

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Factory
Wallingford
Conn.

Pacific Coast Distributors

Dunham, Carrigan & Hayden Co.
San Francisco, California

Illinois Electric Co.,
Los Angeles, California

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Red Stripe

THE possibilities of Dilecto are without end in the electrical field. It possesses every needed qualification for equipment or appliance insulation.

Always uniform and dependable. Replaces to advantage fittings of wood, rubber, leather, porcelain, mica, glass and metals.

Electrical men not thoroughly familiar with Dilecto advantages will be interested in "Insulation"—it contains many important facts about Dilecto, Contex, Conite and Continental Vulcanized Fibre. Consult with a Continental engineer—he can help you!

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SEATTLE, 1041 Sixth Ave. So.
LOS ANGELES, 307 So. Hill St.

WHERE TO BUY

CLASSIFIED INDEX TO ADVERTISERS

Molding, Metal, Wood
National Metal Molding Co.
Pacific States Electric Company
Western Electric Company

Motors, A.C., D.C.
Allis-Chalmers Mfg. Company
Champion Electric Co.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
Electric Controller & Mfg. Co.
General Electric Company
Howell Electric Motors Co.
Ohio Electric & Controller Co.
Wagner Electric Corporation
Western Electric Company
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Motor Generators
General Electric Company
Wagner Electric Corporation
Western Electric Company
Westinghouse Electric & Mfg. Co.

Motor Starters
Condit Electrical Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Company
Industrial Controller Co.
Pacific States Electric Company
Trumbull Electric Mfg. Co.
Wagner Electric Corporation
Ward Leonard Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Oil Burners and Systems
Moore & Company, Chas. C.

Oil Purifiers
De Laval Separator Co., The

Outlet Boxes and Covers
Chicago Fuse Mfg. Company
National Metal Molding Co.

Packings, Asbestos
Johns-Manville, Inc.

Paint, Insulating
Bakelite Corporation
Baker-Joslyn Company
Electrical Specialty Co., Inc.
Pacific States Electric Company
Westinghouse Electric & Mfg. Co.

Panel Boards, Panels
Benjamin Electric Mfg. Co.
Brown & Pengilly
Chicago Fuse Mfg. Co.
Drendell Elec. & Mfg. Co.
General Electric Company
Pacific States Electric Company
Western Electric Company
Western Safety Mfg. Co.
Westinghouse Electric & Mfg. Co.

Pins, Wood, Iron, Steel
Baker-Joslyn Company
Hubbard & Company
Locke Insulator Corp.
Pacific States Electric Company
Thomas & Sons Company, The R.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Pipe, Pressure
Kellogg Company, the M. W.

Plates, Flush Switch
Hart & Hegeman Mfg. Co.
Pacific States Electric Company
Western Electric Company

Plugs, Receptacles, Sockets
Ajax Electric Specialty Co.
Arrow Electric Co., The
Barkelew Electric Mfg. Co.
Benjamin Electric Mfg. Co.
Connecticut Electric Mfg. Co.
Curtis Lighting, Inc.
Electrical Specialty Co., Inc.
Hart & Hegeman Mfg. Co.
Harvey Hubbell, Inc.
Pacific States Electric Company
Pass & Seymour
Western Electric Company

Poles, Iron, Steel, Wood
Baker-Joslyn Company
Bates Expanded Steel Truss Co.
Maydwell & Hartzell, Inc.
Pacific Coast Steel Co.
Pacific States Electric Company
Western Electric Company
Weyerhaeuser Forest Products Co.

Pole Jacks
Maydwell & Hartzell, Inc.

Pole Supports
Clark Williams Eng. Co.

Porcelain Specialties
Baker-Joslyn Company
General Porcelain Co.
Locke Insulator Corp.
Maydwell & Hartzell, Inc.
Pacific States Electric Company
Thomas & Sons Company, The R.
Western Electric Company

Potheads
G & W Electric Specialty Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

Power Plants
Allis-Chalmers Mfg. Company
General Electric Company
Moore & Company, Chas. C.
Westinghouse Electric & Mfg. Co.

Printing
Neal, Stratford & Kerr

Projectors, Electric
Curtis Lighting, Inc.
General Electric Company
Westinghouse Electric & Mfg. Co.

Protective Devices
Condit Electrical Mfg. Co.
Roller-Smith Company

Pulleys
Rockwood Mfg. Co., The

Pumps
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works)
Moore & Company, Chas. C.
Pelton Water Wheel Co.
Westinghouse Electric & Mfg. Co.
Worthington Pump & Machy. Corp.

Push Buttons
Benjamin Electric Mfg. Co.
Electric Controller & Mfg. Co.
Harvey Hubbell, Inc.
Pacific States Electric Company
Western Electric Company

Radiators, Electric
Majestic Electric Appliance Co.
Reiman Wholesale Electric Co.
Westinghouse Electric & Mfg. Co.

Radio Apparatus
Electric Appliance Co.
Illinois Electric Co.
Montana Electric Co.
Pacific States Electric Company
Washington Electric Supply Co.
Weston Electrical Instrument Co.
Wholesale Electric Co.

Ranges, Electric
Alexander & Lavinson Co.
Edison Electric Appliance Co.
Electric Appliance Co.

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Linderman & Hoverson Co., A. J.
Pacific States Elec. Co.
Rathbone Sard & Co.
Standard Electric Stove Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Rail Bonds
General Electric Company
Ohio Brass Company, The
Western Electric Company
Westinghouse Electric & Mfg. Co.

Rectifiers
General Electric Company
Pacific States Electric Company
Wagner Electric Corporation
Western Electric Company
Westinghouse Electric & Mfg. Co.

Reflectors
Benjamin Electric Mfg. Co.
Curtis Lighting, Inc.
Harvey Hubbell, Inc.
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Refrigerators—Household
Electro-Kold Corp., The
Kelvinator Corp.

Regulators, Voltage
General Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Reinforcing Bars
Pacific Coast Steel Co.

Relays
Condit Electrical Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Company
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Resistances
Electric Controller & Mfg. Co.
General Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Rheostats
Electric Controller & Mfg. Co.
General Electric Company
Pacific States Electric Company
Ward Leonard Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Roofing and Siding, Asbestos
Johns-Manville, Inc.

Rosettes
Arrow Electric Co., The
General Electric Company
Hart & Hegeman Mfg. Co.
Pass & Seymour

Safety Testers
Doble Engineering Co.

Searchlights
General Electric Company
Pacific States Electric Company

Separators, Oil
DeLaval Separator Co., The

Sockets, Pull
Arrow Electric Co., The
Harvey Hubbell, Inc.

Solder, Self-fluxing, Solid Wire and Bar
Baker-Joslyn Company
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Solenoids
Electric Controller & Mfg. Co.
Westinghouse Electric & Mfg. Co.

Space Heaters
American Resistor Co.

Stationery
Neal, Stratford & Kerr

Steel, Structural and Reinforcing
Lehigh Structural Steel Co.
Pacific Coast Steel Co.

Street Lighting
General Electric Company
Pacific States Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.

Strip Heaters
American Resistor Co.

Substations
Lehigh Structural Steel Co.
Railway & Industrial Eng. Co.
Westinghouse Electric & Mfg. Co.

Subway Boxes
Johns-Pratt Company, The

Switchboards
Allis-Chalmers Mfg. Co.
Baker-Joslyn Company
Condit Electrical Mfg. Co.
Elec. Power Equipment Corp.
General Electric Company
Johns-Manville, Inc.
Pacific States Electric Company
Trumbull Electric Mfg. Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Switches, Automatic Time
Anderson Mfg. Co., Albert & J. M.

Switches, High Tension
Allis-Chalmers Mfg. Company
Condit Electrical Mfg. Co.
Elec. Power Equipment Corp.
General Electric Company
Johnson, T. F., Jr.
K-P-F. Electric Co.
Trumbull-Vanderpoel Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

Switches, House Service
Arrow Electric Co., The
Baker-Joslyn Company
Benjamin Electric Mfg. Co.
Condit Electrical Mfg. Co.
Connecticut Elec. Mfg. Co.
Elec. Power Equipment Corp.
General Electric Company
Hart & Hegeman Hfg. Co.
Harvey Hubbell, Inc.
Pacific States Electric Company
Pass & Seymour, Inc.
Reiman Wholesale Elec. Co.
Trumbull-Vanderpoel Elect. Mfg. Co.
Western Electric Company
Westinghouse Electric & Mfg. Co.

Switches, Motor Controlling
Barkelew Electric Mfg. Co.
Condit Electrical Mfg. Co.
Electric Controller & Mfg. Co.
Electric Power Equipment Corp.
Electrical Specialty Co., Inc.
General Electric Company
Industrial Controller Co.
Johns-Pratt Company, The
Pacific States Electric Company
Square D Company

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Mr. Harris Qualified with Croft

Mr. Ernest J. Harris of 4215 Church Avenue, Brooklyn, N. Y., writes:

"I qualified as Licensed Master Electrician and there is no doubt in my mind that I would not have passed if I did not have your wonderful set of books to study before I took the examination."

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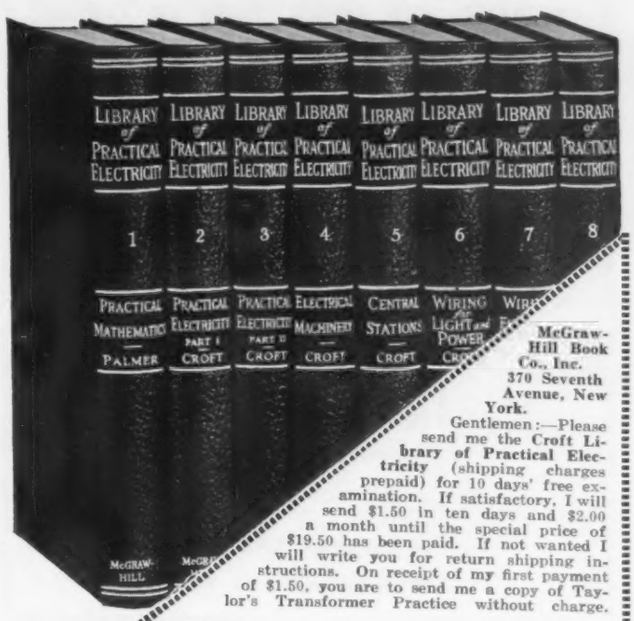

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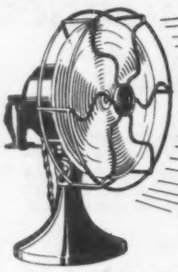

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Lehigh Structural Steel Co.
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Wagner Electric Corporation
Western Electric Company
Westinghouse Electric & Mfg. Co.
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Peerless Ins. Wire & Cable Co.
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Driver-Harris Company

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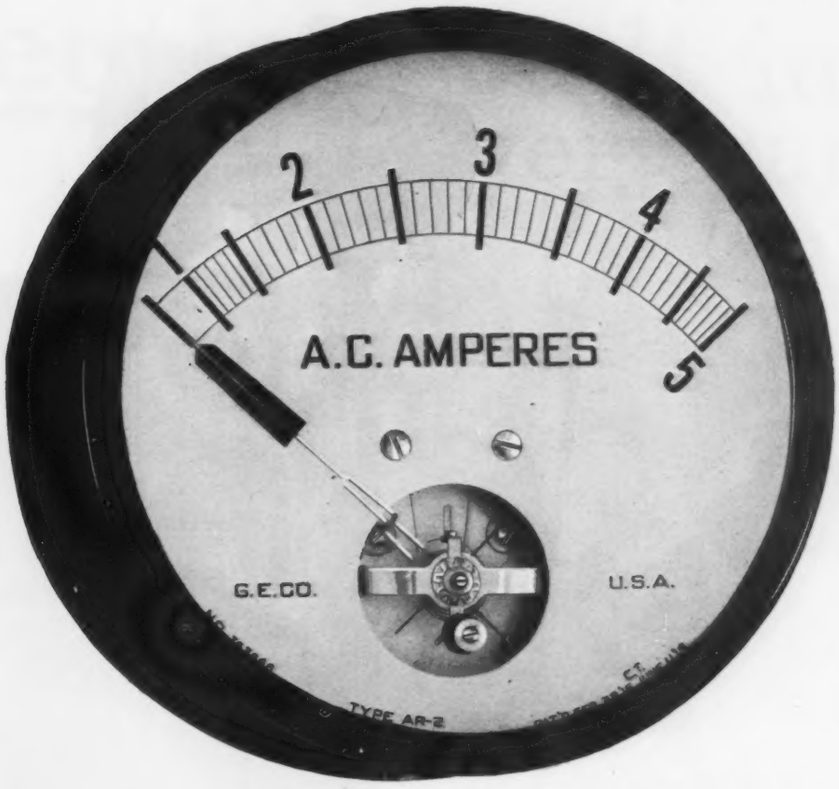
For a cross-indexed list of manufacturers and their Western Representatives, published annually, see issue of Oct. 15, 1924, for last edition.



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On the front of your switchboard these new instruments make most advantageous use of space because the size of the case has been reduced practically to the size of the face.

On the back of your switchboard they simplify wiring and conserve space by having internal resistors (for all ordinary voltage circuits).

They promote good appearance on the switchboard by reason of the uniform size of the complete line, which includes the following instruments:

Direct Current (*Type DR-2*)
Ammeters and Voltmeters

Alternating Current (*Type AR-2*)
Ammeters—Voltmeters—Wattmeters (single and poly-phase)
Reactive kv-a. Meters—Power Factor Meters
Frequency Meters—Synchronism Indicators

Users of other G-E Round Pattern Instruments will observe that this new line also has the "Bunker Hill" pointer, so named because of its shape and the fact that its prominence resembles the "Bunker Hill" monument as it stands out against the sky. This pointer adds materially to the legibility of these instruments.

35-14

GENERAL ELECTRIC

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220,000 Kv-a. for one Station

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It was necessary for the Niagara Falls Power Company to install still larger transformers than ever before built, as there was a premium on efficiency and the only space for installation was an extension of the forebay wall. Ten General Electric 22,000-kv-a. machines were ordered.

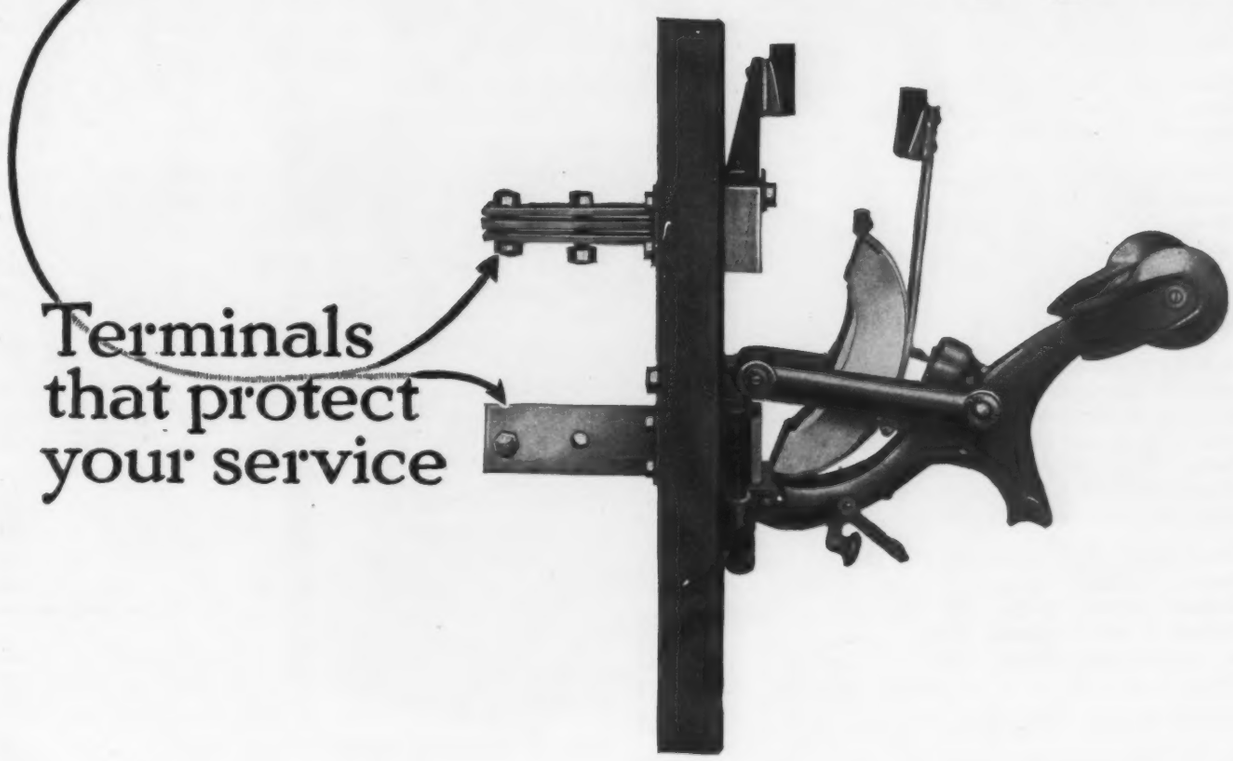
These 25-cycle units required parts which, if used for 60-cycle transformers, would have made single-phase units of more than 50,000 kv-a. capacity each. They are built to withstand the full short-circuit stresses encountered on such large power systems.

17DH-3

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

Protection—built in every part



Where circuit breaker terminals have adequate contact surface—connections are easy to make and sure to stay—they will carry your load without undue heating. That is one reason why

G-E Air Circuit Breakers

are preferred. Laminated studs facilitate the fastening to busbars and making up cable connections. They make unnecessary extra-size holding and spacing nuts and special tools. They make possible a quick, effective and permanent connection, and are an important unit of the current-carrying parts of the Breaker.

All G-E Air Circuit Breakers above 1200 amp. capacity have these laminated studs. They are furnished on G-E Switchboards or separately. For full information ask the nearest G-E Office for Bulletins 47530—47540—67550.

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GENERAL ELECTRIC

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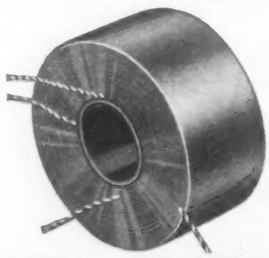

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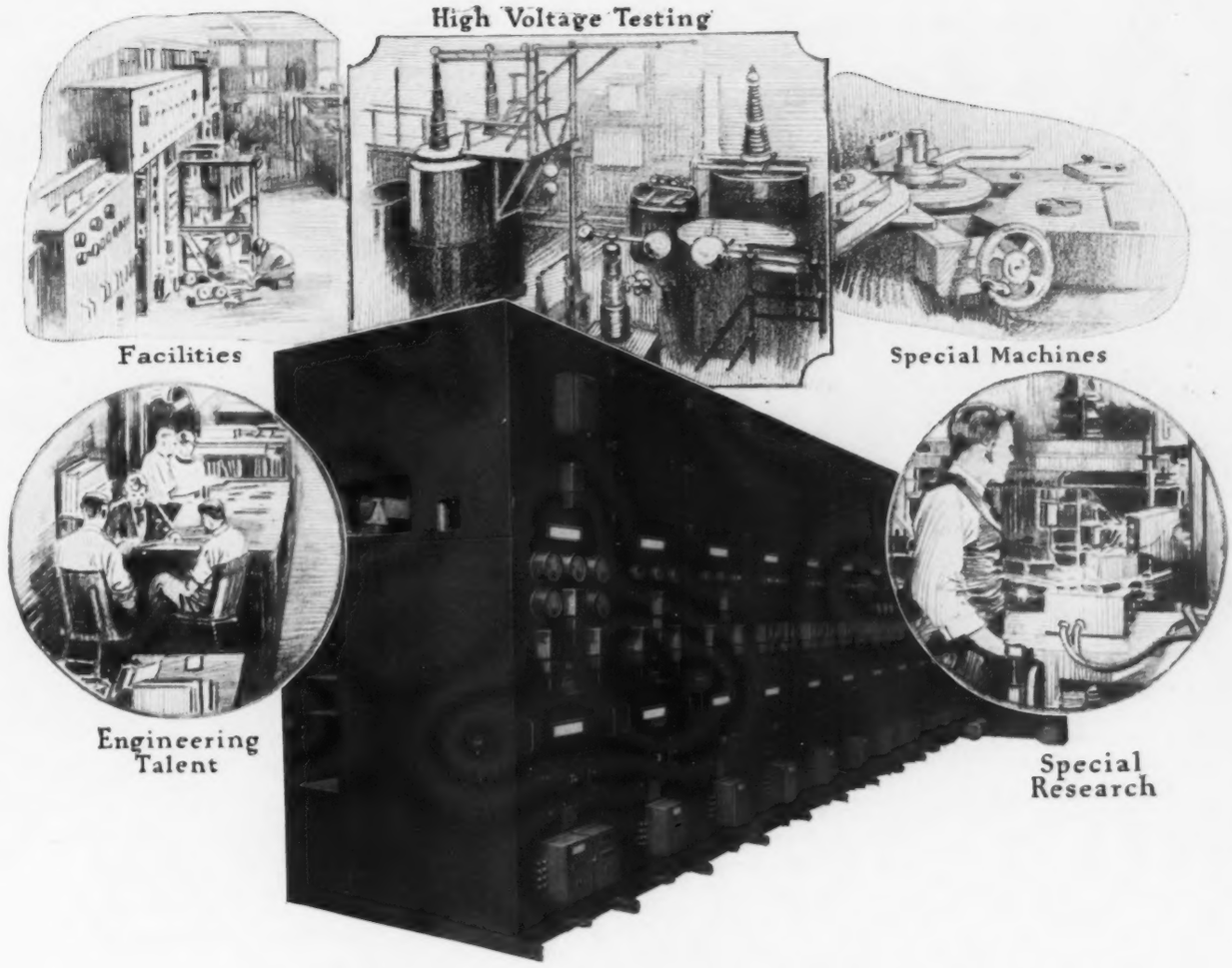

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Large-volume production is to your advantage.

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—the use of special machinery and tools essential to building better switchboards;
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22A-5

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

Globar

Non-Metallic

Heating Units

"Can be mounted readily in any position"

Electrical Appliance Manufacturers have been quick to see the more simple and finer appearing designs—the better operating appliances and the low cost production possibilities that are brought about by the incorporation of the Globar Element. The great utility and excellence of this unit, however, is not confined to the mounting feature alone, though this feature in itself warrants adoption of the unit. Globar Elements require no multiple supports of refractory materials, and offer a combination of features that are attracting many manufacturers and opening the way to more practical and economical designs.

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Unaffected by liquids or gases. Has less expansion than other elements.

Greater radiation efficiency. Terminals operate reasonably cool.

Decreases mounting and replacement difficulties. Can be replaced without disturbing mountings or terminal connections.

Globar Elements are designed and manufactured to fit each specific application.

Globar Elements insure against burnout as material does not decompose under 3300° F.

Submit your electric heating problems to our Engineering Development Laboratories. Bulletins on request.

Showing Globar elements in electrical range installation.

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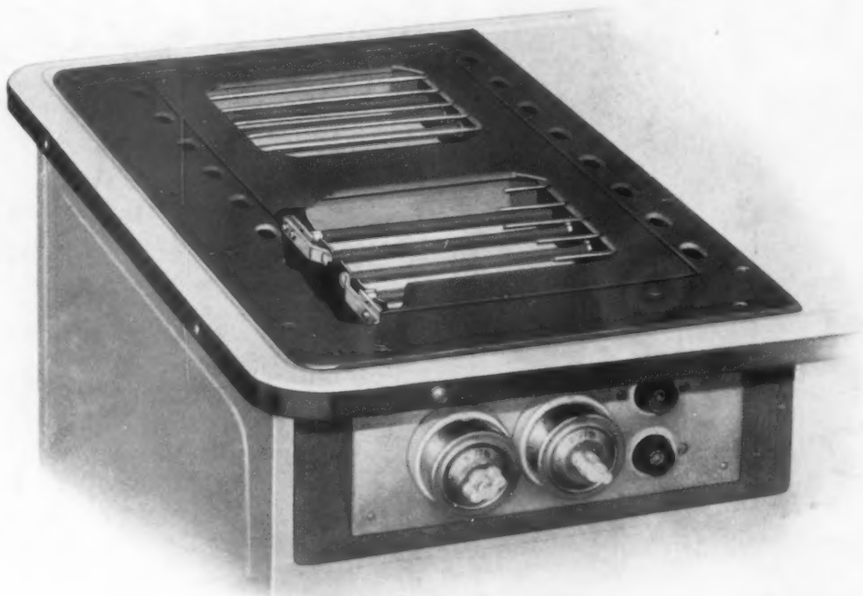
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